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THE AMERICAN GAS LIGHT JOURNAL

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BRIEFLY TOLD.

"ELECTRICITY" AND THE AUER-WELSBACH BURNER.—Our esteemed contemporary *Electricity*, who, by-the-way, is the same authority that, last October, in commenting on the Washington meeting of the American Gas Light Association, emitted the opinion and belief that the "future of the gas industry" was behind it, is at present very much perturbed over the favor which is attending the Welsbach lamps. Of course our contemporary cannot see anything of merit in the Welsbach incandescent gas burner, and is very positive in asserting that it is in no sense a real competitor with the incandescent electric lamp; nevertheless a right goodly share of *Electricity's* space for the past two issues has been given up to the Welsbach lamp, which rather goes to show that our contemporary believes the thing to be worth writing about. We do not propose to enter into any controversy with *Electricity* over the merits of Doctor Auer's burner, the first mention of which in this country will be found in the issue of the JOURNAL, dated May 17, 1886; but we are more than pleased to say that the Auer burner of 1894 is as vastly superior to the burner of 1886 as the 16-candle power incandescent electric lamp of 1894 is inferior to its prototype of 1886. In other words, the Auer burner had advanced, while the Edison burner lamp has retrograded. The electricians have seemingly learned what the generating of steam power for the actuation of dynamos means, and the gas men are more than awakening to the possibilities of their product, which stands as the representation of the development of energy only once removed.

MEMORIAL ACTION OF THE GUILD OF GAS MANAGERS IN RESPECT TO THE LATE MR. S. G. STINESS.—At a meeting of the Guild of Gas Managers, held at Young's Hotel, Boston, Mass., on the 8th of December, 1894, the President announced the death of Mr. Samuel G. Stiness, whose decease occurred at Pawtucket, R. I., on the 5th ult. On motion of Mr. A. B. Slater, the President appointed Messrs. A. B. Slater, H. B. Leach and C. F. Spaulding a committee to prepare a suitable minute to the memory of the deceased, to be entered upon the records of the Guild. Subsequently the committee reported the following:

"Samuel George Stiness, one of the original members of the Guild of Gas Managers, died on Monday, November 5th, 1894, in the 65th year of his age.

"His first connection with the gas industry dates back to the summer of 1864, when he engaged himself to the Providence Gas Company, and was assigned to Col. Armington, who was then Superintendent of the Company works at the corner of Benefit and Pike streets. He continued with the Company up to June, 1869, when he resigned to take the position of Superintendent of the Pawtucket (R. I.) Gas Company, which place was made vacant by the death of Mr. Henry Crowell. He continued in this position up to the time of his death.

"Mr. Stiness was one of the original members of the New England Association of Gas Engineers, which was organized in Boston on the 2d day of February, 1871. He became a member of the American Gas Light Association in October, 1879, was elected a member of its Council for two years (1889), and at the last meeting of the Association, held in the city of Washington, D. C., in October last, he was elected Third

Vice-President. He was also a non-resident member of the Society of Gas Lighting, of New York.

"In all these Associations he was an active member, both in the preparation of papers and in the discussions which followed the reading of papers, as well as the other topics presented for consideration. His active temperament, his ready judgment and his comprehensive mind peculiarly fitted him to discharge the duties of the responsible position of Manager of the business of the Pawtucket Gas Company.

"The gas and electric works of the Company at Pawtucket stand to-day as a monument of his skill, wise foresight and sound judgment as a gas engineer.

"In all our social gatherings he was a conspicuous example of the ready speaker, who could always command the applause of his hearers. We shall sadly miss his genial presence, and, still more, the benefit of his imparting to us the long experiences in the business to which he had devoted so long a portion of his life.

"*Resolved*, That a copy of these minutes be entered upon the records of the Guild, and that a copy be sent to his family.

A. B. SLATER,
H. B. LEACH,
C. F. SPAULDING, } Committee."

MINUTE PASSED BY THE SOCIETY OF GAS LIGHTING TO THE MEMORY OF MR. S. G. STINESS.—At a meeting of the Society of Gas Lighting, held at No. 39 East 31st street, New York, on the afternoon of Thursday, November 8th, 1894, the President *pro tem.* announced the death of Mr. Samuel G. Stiness, a non-resident member of the Society, who died in Pawtucket, R. I., on the 5th November, and appointed Messrs. A. B. Slater, H. B. Leach and Col. Fred. S. Benson a committee to prepare a suitable minute to be spread upon the record of the Society. At the 20th annual meeting of the Society, held at No. 39 East 31st street, New York, on Dec. 13, the committee submitted the following, which was approved and ordered to be spread upon the records:

"Samuel G. Stiness, a non-resident member of this Society, died on Monday, November 5th, at Pawtucket, R. I., in the 65th year of his age. Mr. Stiness entered the gas industry, in the summer of 1864, as assistant to Col. Armington, who was then Superintendent of the works of the Providence Gas Company, at Providence, R. I. In June, 1869, he resigned his position with the Providence Gas Company to accept the position of Superintendent of the works of the Pawtucket (R. I.) Gas Company, in which office he continued to the time of his death.

"Mr. Stiness was one of the original members of the New England Association of Gas Engineers, which was organized in Boston on the 2d day of February, 1871. In October, 1879, he was elected a member of the American Gas Light Association. In 1889 he was made a member of the Council for two years, and at the last meeting of the Association, held in the city of Washington, D. C., he was elected one of the Vice-Presidents.

"Mr. Stiness was also one of the original members of the Guild of Gas Managers, of Boston.

"His active temperament, coupled with his indomitable perseverance and a critical knowledge of the gas business, made him a prominent factor in any organization with which he connected himself. The gas and electric works of the Pawtucket Company attest his judgment and skill as a manager, and was appreciated by his Directors, who will miss his conservative yet energetic management.

"Socially, deceased was entertaining, and our gatherings were always made more pleasant by his presence.

"While we shall keenly feel his absence at our meetings, we shall always hold in grateful remembrance the many genial qualities of his mind and heart, and know that the world was better for his having lived in it.

"*Resolved*, That a copy of these minutes be spread upon our records, and that a copy thereof be sent to his family.

A. B. SLATER,
F. S. BENSON,
H. B. LEACH, } Committee."

NOTES.—The Addyston Pipe and Steel Company, of Cincinnati, Ohio, has just issued a well prepared pamphlet on the "Altitude and Discharge of Fire Streams," the computations in which were made by that well known authority on such matters, Mr. John W. Hill, C. E., of Cincinnati, Ohio. The diagrams are very distinct, and the letterpress is perfect. The pamphlet also contains a ready reference table relating to the weights, in pounds, of cast iron pipe for gas and water mains. ——Mr. James H. Wordin has resigned the position of Manager to the Glens Falls (N. Y.) Gas Light Company, and Mr. Joseph E. Miron, of Troy, N. Y., has been appointed his successor.——Mr. James H. Moran has been appointed Receiver of the Consolidated Gas Company, of Rye, Port Chester and Mamaroneck, N. Y., at the instance of the Holland Trust Company, which is foreclosing a mortgage of $250,000 on the works.

Inclined Retorts at the Leigh (England) Gas Works.

[A paper read by Mr. Alfred T. Fletcher, at the Meeting of the Manchester District Institution.]

During the last four or five years, few matters have occupied the attention of gas engineers to a greater extent than those connected with the retort house, and especially with the best means of reducing the cost of carbonization, the labor cost of which is the largest item in the manufacture of coal gas. As a result of this attention, it cannot be wondered at that considerable advancement has been made, not only in the reduction of the cost for labor, but also in the production of larger quantities of gas from the same amount and class of coal, without any loss of illuminating power, and to the greater comfort of everyone connected with a gas works. These improvements have not been effected without considerable thought and expenditure; and this applies to all the systems of mechanical stoking adopted in gas works.

The demand for gas having rapidly increased in Leigh during the five years 1887–92, from 47 to 75 millions, repeated extensions had to be made to meet this large increase, and it became necessary for me to consider the means of best obtaining additional carbonizing plant, and especially to utilize to the fullest extent the existing floor space of the retort house. The paper which I have now the pleasure of submitting to you includes the whole of the extensions carried out by me on the inclined retort system, together with my experience in working the same.

Our retort house, which is 150 feet long by 54 feet wide, in the beginning of 1892 contained two benches of retorts, one on each side of the chimney stack, which occupies the center of the house. One bench consisted of seven double settings of fives, or a total of 70 mouthpieces, each retort being 18 in. by 15 in. by 8 ft. 6 in. long, and heated by 14 furnaces on the direct firing system. These retorts were capable of carbonizing, by six hour charges, 28 tons in 24 hours. The other bench consisted of three double settings of fives, each 21 in. by 15 in. by 9 ft. 6 in. long, and four double settings of sevens, each 18 in. by 15 in. by 9 ft. 6 in. long; or in all a total of 86 mouthpieces. These were heated by 7 generator furnaces of my own design, placed on one side of the settings only. This bench was capable of carbonizing 45 tons in 24 hours. The first named bench required the whole of the retorts renewing; but as we were then working at nearly our full power, I decided that it would be better to demolish it, and erect in its stead either generator settings of larger capabilities or adopt some more modern method of carbonization.

I had previously given considerable attention to the early installations of inclined retorts; and I was fully satisfied that—with a few alterations, to adapt them to the requirements of our works—we were likely to get good results. The plan I decided upon was to erect on the site of the old settings in one-half of the house a bench of 7 settings; provision being made to allow sufficient floor space for the duplication of the same immediately opposite them. This was carried out in the summer and autumn of 1892.

The retorts are Ω-shaped, 21 in. by 15 in. by 12 ft. long, and are set at the respective angles of 31°, 31½°, and 32°. They are fitted with self-sealing mouthpieces at both ends, the lower ones being 8 inches deep only, and the upper ones 17 inches, to allow for the sockets for the ascension pipes, which are tapered, 7 in. to 6 in. diameter; the bridge pipes also being 6 in.

The heating arrangements for this bench are on the generator principle; the furnaces being similar in design to those erected for the horizontals in the other section of the house, and which, together with the settings and retorts (though six years old), have never yet required renewal. The setting is simple and gives every satisfaction, and it overcomes the irregularity in the distribution of the heat I had observed during my inspections of the early installations at other works. There is no doubt that the successful working of inclined retorts depends upon this important point, it being necessary that the lower end should have the same degree of temperature as the upper one. The generators are fed on the drawing side by means of a movable charger, which allows the coke to be drawn directly from the retort into the furnace, without any extra labor in second handling, and also effects a saving in the consumption of fuel. The amount of coke used in these furnaces, averaged over the year's working, is 14 lbs. per 100 lbs. of coal carbonized. It varies according to the quality of the coal used, of which there are five different kinds. Underneath the drawing stage is the subway for affording access to the ashpits and various regulators in connection with the furnace air supplies. The ashpits are constructed of blue bricks, set in cement mortar, and steam and water are used under the fire bars. Clinkering is almost unnecessary, and only takes place every three or four weeks. An inclined passage leads from the subway to the yard level,

for the conveyance of ashes, etc. The bench, which measures over all 70 ft. long by 10 ft. 4 in. wide on the horizontal, is bound together by rolled steel buckstays, cross stays, tie rods, etc., which provide support for the drawing and charging stages, hydraulic and foul mains, measuring chambers, coal storage hoppers and elevator gearing.

In the first design, with a view to saving the expense of raising the retort house roof—the height of the walls being 21 feet from the ground floor—it was decided to dispense with coal storage tanks and fix measuring chambers only, which were filled directly by means of a push plate conveyer, an opening and slide being allowed in the trough for each chamber. By this means the small hoppers were fed automatically. At the end of the bench a drop shoot and signal were arranged to indicate the completion of the filling. The coal handling and elevating system, which will be further explained, was equal to the requirements.

These retorts having, during the winter months of 1892, given satisfaction, it was decided to go on with the duplication of the system as previously provided for. This extension was carried out in the following manner: The bench of inclines was covered, to protect it from the weather, and the whole of the slates over that half of the retort house were removed. The laths were taken off, and the principals were lowered to the ground intact. The side walls were then raised a height of 4 feet, and the piers continued to 10 feet, so as to form a solid rest for the longitudinal latticed girders to carry the principals. These, after being scraped and painted, were placed in position, the gable wall was carried up, and the laths and slates replaced. This allowed very efficient means of ventilation, head room, access and light to all the plant. The cost of this portion of the extension was $1,662.50, the part of the roof raised measuring 80 ft. long by 54 ft. span. The necessary excavation was then made for the bench, which was erected and completed similar in design to the previous one.

After the winter's working with the measuring chambers only, I decided to erect storage tanks for coal sufficiently large to hold 24 hours' supply, and thus do away with any necessity for running the coal handling plant during the night time. This was done not only to the new bench, but also to the older one, in which case the conveyer had to be removed from the tops of the measuring chambers, and placed on the large coal hoppers. The coal elevator was lengthened, and a shoot arranged for conducting the coal to either bench by means of a transverse conveyer. Improvements were also made in the coal store, which lies parallel to, and adjoining, the retort house; and a 10-horse power (nominal) steam engine was fixed. By means of a series of clutches overhead, each portion of the conveying plant can be worked independently.

I might mention here that I have lined the whole of the slides on the elevator and conveyer troughs upon which the skids of the buckets and scrapers run, with hard wood, about ½ inch in thickness. The result of this has been to reduce the wear and tear considerably, and also (amongst other benefits) the noise of the scraping motion to a minimum—to the better comfort of the workmen.

Immediately outside the retort house was fixed a coke handling plant, to receive the quenched coke as it is brought from the retorts, and elevate it to a height of 28 feet, where it is deposited on a movable screen, from which it falls into a conveyer running the whole length of a coke storage hopper, which it automatically fills. This hopper will hold 40 tons of coke—about equal to our present maximum daily make; and it is used for the more rapid filling of carts, etc.—the yard being also kept much cleaner at less expense. When the hopper is full (which hitherto has occurred very seldom) means are provided for carrying the coke on to the coke ground adjoining.

The total cost of our entire inclined retort installation—including excavations, coal handling plant, coal hoppers, all ironwork, floors, subway, and benches complete—was $30,280, which is under $415 per ton of coal carbonized per day. It is only fair in giving the cost of this work that due allowance should be made for a retort house which would have had to be erected to provide the same carbonizing power; and parliamentary powers would have had to be obtained for the purchase of additional land.

This works affords good opportunity for the comparison of the utilization of the area necessary for the two systems; the entire retort house being divided into two sections, the chimney stack being in the center, inclined retorts carbonizing 73½ tons and horizontals 45 tons per day.

Having now explained to you the construction of the system, I will endeavor to interest you with the various points which have particularly come under my notice during the working; and I propose to commence at the elevation of the coal from the coal store. The coal and cannel are delivered in the store by carts, which deposit their contents around and upon the coal breaker, which is fixed beneath the floor line of the store. The coal is broken to the proper size and elevated a height of 36 feet to the conveyers running over the large coal tanks. This is only done during the ordinary working hours of the daytime, and whilst the carting is taking place; and the cost of this handling—including oil, etc., and labor attending to engine and all machinery connected with the plant—works out to 2 cents per ton carbonized.

With regard to the various classes of coal employed, I may say we are using best Wigan cannel from the Abram district, and unscreened Arley coal, Arley cobbles, and Arley nuts of various sizes; and last year, during the coal strike, we used on inclines, Durham, Derbyshire and Scotch coal.

It is unnecessary for me to enter into any details with reference to the charging methods of this system, as they have been fully explained previously to the gas profession. I would like, however, to mention that we have perfect means of regulating the weight and delivery of the charge into the retort—the usual charge being 3¾ cwt. The comparison which I have been able to make between the charges in horizontal and inclined retorts, is that in the latter the fuel, on account of the velocity of flow down the shoot, lies closer together, and therefore in my opinion a larger charge of coal is carbonized in them. At the same time the heats require to be good and regular, so as to penetrate the charges.

There is no difficulty in removing the carbon deposited, providing it is done at regular intervals. The process which I have found to answer very well is to insert weekly a scraper of similar section to the retort; and, if this is carried out, the retorts will run through a winter's work without further attention in this respect. The result also follows that the wear and tear of the retort is lessened considerably, and we have retorts at present working after 410 days' use which are still in good condition.

The gas is taken off from the upper ends of the retorts by means of 7-inch diameter ascension pipes. In the first installation I used up the ascension pipes of the old horizontal bench taken down, which were 5 inches in diameter, and was troubled in working with constant stoppages. Since increasing the size to 7 inches, this drawback has entirely disappeared; and the reason appears to me to be that the difficulty caused in the first place was owing to the fact that the gas coming from so large a charge could not get away quickly enough.

The tar produced on these settings (averaged over two years working) is 1.27 cwt. per ton of coal and cannel carbonized; the quantity from the horizontals in the same house, from similar coal, being 1.22 cwt. per ton. No trouble is found with tar in the lower mouthpieces, owing, I imagine, to their being so short—namely, 8 inches deep—and to the ascension pipes being placed at the other end.

The much discussed question of illuminating power can, in my opinion, be explained in a few words. Having done the whole of the carbonizing we require by this system alone, I have had the opportunity of thoroughly comparing the quality and quantity of the gas produced on both horizontals and inclines; and the results of careful tests, made over limited and extended periods, and consequently with both selected and ordinary working quantities of coal, convince me that there is no appreciable difference—the majority of my observations being slightly in favor of inclines.

The retorts are drawn in such a manner as to prevent any interference in the work of the two gangs of men employed. The drawing stage is not as wide between the two benches as I should have liked. The total width of the retort house is only 54 feet, and this is taken up by two charging stages (one on each side of the house), each 8 feet 8 inches, two benches each 10 feet 4 inches, and one drawing stage 16 feet—this being the most efficient way of dealing with the limited area. The men are divided into two gangs, each gang of three men, 8-hour shifts; making a total of nine men on each bench per 24 hours. The work done by these men consists of drawing and charging, wheeling out coke to the yard, and attending to the fires (except clinkering, which is almost abolished here, and is done by the yard men at a cost of ¼ cent per ton). They are paid $1.25 each, or $11.25 the lot, per day for carbonizing 36 tons 15 cwt., which equals 30.5 cents per ton. The total cost of carbonizing and handling the coal and coke is 33 cents per ton, as against 65 cents on our horizontals. In drawing the retorts, one gang commences on the even hours, and the other on the odd hours; and one tier of retorts on the whole of the seven beds is taken each time—an operation lasting usually 40 minutes.

Before concluding, I wish to express my opinion with reference to the starting of carbonizing plants, and say that certainly there are several points which require careful attention before smooth working can be obtained. My experience is that if anything occurs to horizontal retorts, the men having been accustomed to them so long make nothing of the difficulties; but when commencing a new system such as in-

clines, every little drawback is magnified. It is, therefore, a source of wonder and gratification for me to be able to say that even after so short a period has elapsed since its introduction, the work is now carried on at Leigh without the slightest trouble or hitch of any kind.

The Heating of Greenhouses and Conservatories by Coal Gas.

[A paper read by Mr. William R. Chester, at the Meeting of the Manchester District Institution.]

Probably many of the members of this Institution will, at one time or another, have had their attention turned to the possibility of heating small or moderate sized greenhouses with coal gas, and some of them will probably have carried out schemes for accomplishing this purpose. The great difficulty, however, in the way of a more extended application of the system is the cost of gas as fuel, which if burned continuously at even a small rate per hour throughout the day and night soon runs up the cost to considerable figures. In spite of this drawback, however, I am inclined to think that, when all things are properly taken into consideration, it will bear a favorable comparison with any other system of heating; and if an automatic arrangement be applied to the gas supply, to increase or diminish the consumption in exact accordance with atmospheric variations of temperature, it will be found that gas is both cheaper and better adapted than any other form of fuel for greenhouse purposes—at any rate, in all those cases where a moderate temperature only of, say, 50° to 60° is required.

If we take a moderate sized conservatory of the lean-to type, 20 feet long, 12 feet wide and 10 feet high at the top, sloping to 6 feet at the eaves, we shall have a superficial area of glass amounting to about 440 square feet. Each square foot of glass surface is capable of cooling 1¼ cubic feet per minute of heated air in the interior of the conservatory to the temperature of the atmosphere outside; so that with a glass surface of 440 feet superficial, 550 cubic feet of air will be lowered to atmospheric temperature per minute. In order to maintain a constant temperature in the conservatory it will, therefore, be necessary to provide so much heat per minute as will raise the temperature of 550 cubic feet of air the number of degrees which is the difference between the interior and the exterior temperatures of the air—say about 30° F. The normal interior winter temperature required is about 50° F.; the exterior temperature seldom going lower than 20° F., or 12° of frost. Of course, the atmospheric temperature often gets lower than 12° of frost; but not in sheltered places, such as those in which conservatories are usually built.

Now 550 cubic feet of air represents about 45 lbs. in weight; and the specific heat of air being .2375 as compared with water, we shall require to develop as much heat as will raise the temperature of 10.6 lbs. of water 30° F. per minute, which is 318 B. T. U., or 19,080 units of heat per hour.

In a specially constructed boiler made to utilize, say, 80 per cent. of the total heat developed from the combustion of coal gas, we should be able to do this work with a consumption of 30 cubic feet of gas per hour, or 720 feet per day, which would cost, at 62.5 cents per 1,000 cubic feet, say, 44 cents. This consumption is based on the rather extreme supposition that the low temperature of 12° of frost would continue throughout the 24 hours; but as this is a rare occurrence, we may take it that the comparison is as unfavorable to gas as it is possible to make it. If during the daylight the atmospheric temperature should rise, the automatic regulator would come into operation and at once reduce the consumption of gas, and proportionately diminish the cost. It would not, therefore, be unfair to take the cost of gas at 37.5 cents per day, as an average. On the other hand, if a conservatory of similar size were heated by coal or coke burnt in an ordinary saddle boiler, such as is customarily used for the purpose, it would require from 1½ to 2 cwt. per 24 hours, which, at, say, 16 cents per cwt. delivered, would cost from 25 cents to 33 cents per day. Add to this the wages of an attendant to fire up and clear away the ashes, say 2 hours per day, at 10 cents per hour, the cost would be 45 cents to 54 cents per day. If the greenhouse be heated by hot air flues instead of by water pipes, the consumption of coal or coke would be still greater.

Extremes of temperature are always detrimental; and where solid fuel is used it is next to impossible to maintain that regularity in small greenhouses which is so essential. On this point alone the use of gas for heating purposes possesses an immense advantage. With solid fuel firing, the furnace is filled up at periods of the day or night; and as it burns through there is an excess of heat developed, which raises the temperature of the house too high. Then as the fire burns down it is allowed to fall too low; and unfortunately sometimes, at critical periods, the fire has a way of burning out from want of attention, and thus producing perfectly disastrous results. With the gaseous fired boiler specially constructed for the purpose, this variation can never occur, and it may be depended on to maintain the temperature required with perfect regularity.

This specially constructed boiler, capable of maintaining the above high ideals, has yet to be made; for though I have experimented with many types, as at present manufactured, there are none which yet come up to to the mark, and some of them fall very far short of it. The boiler must be constructed with a studded bottom, and interior tubes with gills or studs on the inside for rapidly absorbing the heat and transmitting it to the water. It must be of such length as to absorb all the heat developed by the combustion of the gas except just the amount necessary to insure a continuous upward current; and it must be boxed in round the burner so as to admit no more air than is just sufficient for the complete combustion of the gas. At the top it must be provided with a cover and flue pipe for carrying away the products of combustion. The flow and return openings must be not less than the water pipes to be heated—say 3 inches in interior diameter; and the burner must be constructed to consume the maximum and minimum quantities of gas with perfect combustion. It must not fire back under any conditions, and when not required it must automatically shut off all the gas except the supply to a small pilot jet, which will at once re-ignite the gas at the burner when further heat is required. The consumption of gas must be controlled by the temperature of the conservatory, and automatically increased or diminished within fixed limits, which may easily be determined. When we have such a boiler—and there are no inherent difficulties in its construction—we shall, I am confident, have a wide field for the further development of coal gas for conservatory heating; and my principal object in writing this paper is to direct the attention of makers into this particular groove. It will be a profitable one both for them and for the gas producer.

Having outlined the possibilities which are to be attained in this direction, I will now give briefly the results obtained from an arrangement I have recently fitted up at Bestwood Lodge for the Duke of St. Albans. The conservatory is 41 feet 6 inches long, 26 feet wide, and 24 feet high from floor to apex of roof. The glass surface is 1,965 square feet, and the cubical capacity is 19,162 cubic feet. The heating pipes are 3 inches in diameter, having a surface area of 431 square feet. The pipes were already in. The boiler is constructed of sheet copper, 15 inches in diameter and 2 feet high, with 1 inch vertical copper tubes, capped at the top and fitted with a flue pipe for carrying off the products of combustion. The burner (atmospheric) is boxed in at the bottom, and perforations are made for the admission of the necessary quantity of air to insure complete combustion. The burner is of the ring type, with separate taps. The boiler is placed in a second conservatory, which it heats by radiation; and the flow and return pipes have to pass outside a distance of 25 feet before they enter the large building. So that the conditions are entirely against obtaining favorable results. With a consumption of 60 cubic feet of gas per hour, the temperature of the large building was maintained at 66° with an outside temperature of 46°. The temperature of the flow and return pipes (which, by the way, are reduced to 1 inch diameter at the boiler) are as follows: Flow, 132° F.; return, 87° F. The effluent gases leaving the boiler were 380° F.; and their analyses (average of series of tests) were as follows:

Carbonic acid	6.0 per cent.
Oxygen	8.6 "
Nitrogen	85.4 "
	100.0

From these results the following defects are apparent:

(1) The heating surface is deficient—the effluent gases being allowed to escape at too high a temperature.

(2) Too large a proportion of air is permitted to enter with the gas.

(3) The flow and return pipes at the boiler are much too small.

(4) The radiating pipes are much too large for the boiler—*i. e.*, a much larger boiler is necessary for effective work.

I ought to mention that the whole application has been carried out as an experiment, with a view of determining the more correct proportions to adopt in the permanent installation, and to find out, on a practical working scale, how far it is possible to utilize coal gas for such a purpose with due regard to economy.

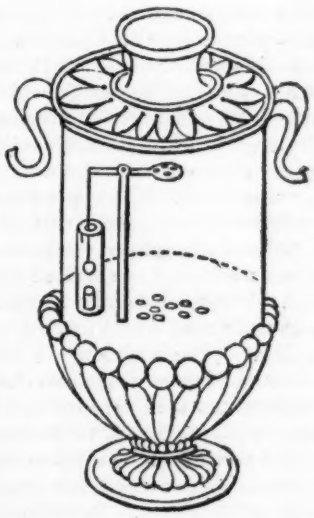
On some future occasion I may have further information on the subject, which will probably be of a wider general interest to the gas industry.

Prepayment Gas Meters.

[A paper read by Mr. J. Nasmith, before a Meeting of the Manchester (England) Association of Engineers.]

A few years ago it looked as if modern society would depend for all its comforts and conveniences upon some form of mechanism, to be set in operation by means of, or subsequent to, the introduction of some coin of the realm into a slot. The success of the weighing machines which were thus controlled set inventors in motion, and a long list of patents were taken for the delivery of nearly every commodity which can be sold for a penny. The early excitement has considerably cooled down, and the successful applications of this popular idea may be counted at present in units instead of tens. Admitting this to be the fact, however, the writer's researches into the matter have convinced him that the mechanism employed possesses an intrinsic interest, and that, when closely looked at, it is seen to be the result of a considerable amount of ingenuity and skill. This is one of the by-ways of modern mechanics, but by following it, it will be found to contain many interesting features, a consideration of which will probably not be unprofitable.

Hero's Coin-in-the-Slot Machine.—The idea of automatically providing a supply of a given commodity by the employment of a coin is not, in the strict sense, modern. In the Pneumatics of Hero of Alexandria, who lived some 300 years prior to the Christian era, a device of this kind



is found. The late Mr. Bennet Woodcroft translated the book; and an illustration of the device is here given. It will be seen that the mechanism consisted first of a lever mounted on a fulcrum, and having at one end a broad palm, which came below a slot formed in the ornamental urn containing the mechanism. To the lever was attached a pendant rod, terminating in a plunger, which worked in a cylinder constantly filled with water or other liquid, supplied from a reservoir in the body of the urn. Attached to the cylinder was an outlet pipe, by which the liquid was conveyed outside the urn. The weight of one end of the lever and its attached parts was such that it kept the lever normally with the palm at its highest point. When a coin was dropped into the slot it fell upon the lever, and thus overcame the weight of the parts operating the plunger and delivering the liquid. This act caused the lever to assume such a position that the coin fell within the urn, where it remained.

It will be seen that this, the first coin-in-the-slot arrangement known to the writer, possesses in it all the chief characteristics of its modern descendants. It even lent itself, like some of them, to deception, for it is believed it was used by the priests as a means of extracting coins in exchange for a liquid assumed to possess magical powers. In one respect it has an advantage over modern machines. When the liquid was there it would deliver it, and we would not expect to have seen the melancholy sight of a youngster howling after the penny which was gone without any adequate equivalent having been delivered. This device is also notable because the *modus operandi* was based on one of two types used to-day.

It may be said generally that there are two main forms of prepayment mechanism used—namely, those in which the coin is used as a weight to overcome the counterpoise of a lever, and those in which the coin is employed as a gag piece between two parts of the mechanism, previously separated from each other. It will be found that all coin receiving mechanism is based upon one of the principles named, although in the particular application about to be considered the latter is the most common.

The Prepayment Principle in Gas Supply.—There is perhaps no application of the prepayment principle which is likely to be so useful as that relating to gas meters. It is very well known to gas managers, and in a less degree to most others that there are large numbers of our fellow citizens who habitually burn candles or oil instead of gas. In Tunbridge Wells, for instance, it is stated by Mr. Dougall, the manager at the local gas works, that out of 5,300 houses no less than 2,975 are using illuminants other than gas, principally oil. The reason for this procedure is plain. If gas is used in the ordinary way it is paid for once a quarter, and the amount is felt to be a serious one by many of our poorer brethren. Further many companies and corporations demand a deposit, which is levied at the beginning of the consumer's transaction with them, and which deposit is retained until consumption ceases. These two causes combined form a sufficiently serious tax to prevent many persons from using gas. Our past-President, Mr. West, in a recent address, gave some figures which show the small number of gas consumers in large populations as compared with the possible number. The writer has added a column of the percentage of consumers to the total population, thus giving a measure which, though possibly not absolutely, is approximately accurate.

Town.	Population.	Number of Consumers. Actual.	Percentage.
Belfast	280,000	23,338	8.33
Bradford	186,000	51.760	27.83
Bristol	310,000	22,600	7.3
Carlisle	42,000	6,301	15.0
Glasgow	760,000	156,980	20.64
Ipswich	56,000	3,050	5.45
Leicester	180,000	25,041	13.91
Liverpool	614,000	76,500	12.46
Newcastle-on-Tyne	275,000	30,471	11.08
Nottingham	250,000	38,005	15.2

The number of consumers in Liverpool include 12,000 using prepayment meters. If, therefore, these be deducted, the percentage of consumers is reduced to 10.5, thus showing how possible it is to add largely to the number of consumers, if proper means are taken. The matter is urgent and of a certain importance, because there is an undoubted tendency in all large towns to adopt an electrical supply of light. It is very true that the use of the electric light is probably confined to those who are willing to pay a sum in excess of the cost of gas, but experience has shown that the public thus defined is a larger one than was at first expected. A brilliant illuminant, or a brilliant application of an illuminant, finds users in spite of cost, and this, it appears to the writer, is the crux of the question. Users of the class named are mainly those who can afford to pay for their fancy, and are large ones, and it is obvious that their place must be supplied by others. The extended employment of cooking stoves, and the provision of means by which those who have not hitherto been consumers may be induced to become so, are the two best lines of policy for gas companies. It is not, however, the scope of this paper to educate gas managers in their business. They know more about this part of the subject than the writer; and it is enough to indicate the difficulties which are ahead of them, and thus show the need of the extended use of prepayment meters. At a later stage some of the steps adopted will be detailed, and it will be seen how much alive many of those concerned are to the grave consideration involved.

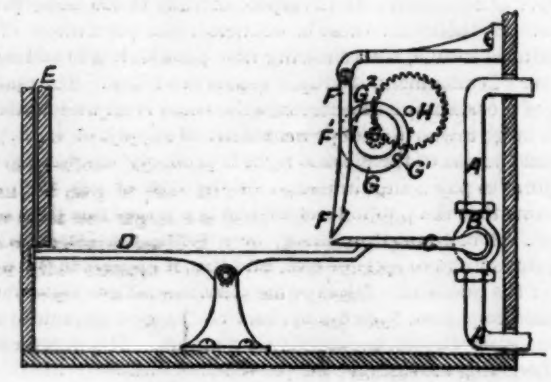
Essential Requirements.—It may at first sight appear to be a very simple matter to devise a piece of mechanism by which a coin or token can be utilized as a means of operating delivery mechanism. Further experience, however, demonstrates the difficulty of this apparently simple task. In the first place, the mechanism must be free from complication, as it is subject to handling by all and sundry, with the result which may naturally be expected. Then it is desirable, for the same reason, that it should be strongly and well made, as any disarrangement of the mechanism is liable to tend to disagreeable consequences. The third requirement, when applied to a gas meter, is that the measuring out shall be accurately done. Any variation in that respect would be fatal. It is also necessary to insure that fraudulent use is not made of the mechanism, a point which is one of great difficulty, as the ingenuity of the public in this respect is unbounded. The space occupied by the attachment must be limited, gas meters being often fixed in positions which are cramped and confined, so that every inch of space is needed. The chief requirements of a prepayment attachment may therefore be briefly summed up as (1) simplicity, (2) strength, (3) accuracy, (4) prevention of fraud, (5) compactness. It is also advisable to

effect a complete separation of the coin receiving and delivering mechanism, so that when no coin is in, the former can be operated without actuating the delivery mechanism, while once the coin is received it should not be recoverable until it has done its work.

It has already been said that prepayment mechanism is mainly divisible into two classes, the first comprising all devices in which the gravity of the falling coin is utilized to produce the effect, and the second those in which the coin is used as a gag or connecting piece between two portions of the mechanism. In applying either of these forms of coin operating devices to a gas meter, two principal methods have been adopted. In one case the action results in the removal of a stop from the path of a meter drum or some other moving part, so as to allow the drum or bellows to work, the stop being again engaged when the required period of delivery is at an end. In the other form the operation of the parts by the coin is utilized to open a valve through which the gas passes into the service pipe, while the operation of the delivery mechanism returns the parts to their initial position, closing the valve and so preventing the passage of gas.

Of these two types of mechanism the latter is, in the writer's opinion, by far the most scientific and effective. To close the orifice through which it must pass is the most natural way of regulating the supply of any liquid or fluid, and, although it may be said that the locking of the tangent pin in a dry, or of the rotation of the drum in a wet meter has the same effect, it is not so perfect a method of regulation. If gas is passing through a meter at a high pressure, and the meter drum or bellows prevented from moving by means of a stop, some gas may flow through the meter if a delivery valve is open. In any case, just as the shutting off of all the taps of the various gas fittings in a house prevents the passage of gas, and thus stops the meter effectually and without shock, so in like manner a similar arrangement applied to the meter itself gives the best result.

The First Slot Gas Meter.—The first declared attempt to apply the popular coin-receiving mechanism to the delivery of gas was made in 1887, by a Mr. John Stewart Wallace, whose patent was numbered



1,620. His arrangement is shown. The gas passed through the pipe *A*, which was provided with a plug tap *B*. On the shank of the plug was fitted a lever *C*, formed at its free end with a slight taper. This lever was normally supported by a balanced lever *D*, one end of which came below a coin shoot *E*. Carried by a bracket from the frame of the case in which the mechanism was inclosed was a pendant lever *F*, formed at its lower end with a hook of the shape shown. At F^1 a second shoulder or projecting piece was formed, with which a pin G^1, in the disc *G*, could engage, and which fell under a shoulder G^2. The disc *G* was driven from the wheel *H* by a pinion fast on its arbor, while *H* was arranged to be driven from one of the rotary spindles of the index mechanism. Although this particular contrivance never came into actual use, it had within it the germ of subsequent devices, so that it will be interesting to follow its action. When a coin dropped down the shoot *E* on to the end of the lever *D*, the latter was oscillated, and raised the lever or handle *C*. This in rising pushed back the pendant lever *F*, until the point of *C* passed over the incline on *F*, when the weight of the latter caused it to drop below *C* and hold it up, thus keeping the valve *B* open. This permitted gas to pass, and the wheel *H* was immediately rotated from the moving parts of the meter. The continued rotation of the wheel *H* is, of course, communicated to the disc *G*, and the pin G^1 eventually presses against the lever *F*, pushing it back so as to release the handle *C*, which falls by its own weight and closes the valve *B*. Although this mechanism is crude, it has the merit of being designed with a clear view of the needs of the case, and takes rank as the earliest invention for the purpose.

By the aid of diagrams Mr. Nasmith decribed in detail the prepayment attachments devised by Mr. Brownhill, Messrs. Thorp & Marsh, Messrs. W. & B. Cowan, Messrs. J. & J. Braddock, Messrs. Sawer & Purves, Messrs. Wm. Parkinson & Co., and Messrs. Thos. Glover & Co., and then proceeded as follows:

Provisions Against Fraud.—Having thus described, in some detail, several different devices for this purpose, it is now possible to say something about the various mechanical features which are specially devised to meet difficulties arising in practice. Remembering the list of requirements laid down at an early stage as essentials, let us see how far the various attachments described meet the case. The arrangements of Thorp & Marsh, Brownhill, and Wallace, it is not necessary to deal with, because, although some of the first-named are in use, they are practically out of the running. It has been said that an arrangement which closes a valve rather than one which stops the meter is to be preferred; and, apart from the reason which has been previously given, this statement has been confirmed by public convenience, which would not be served if failure of the gas supply took place without warning. This is avoided by the use of a valve, which gradually diminishes the supply and so gives ample warning before the shutting off of the gas. As was stated, it is necessary to avoid frand, which it was at one time thought would be very serious. Experience has not justified this anticipation, but it is still necessary to guard against it. Of course, so long as the meter is working the index is registering the quantity of gas passing, and to this extent acts as a check upon the consumer. The most obvious method of cheating the meter would be by putting in the coin, partly operating the mechanism, and then withdrawing it. This is easily and simply met by the employment of a specially shaped rotating cam, by which the coin slide is moved in Cowan's arrangement; by the construction of the ratchet wheel in Braddock's, which will not permit of the return of the coin without reversing the movement of the cam course and so setting the parts to their original position; and by the small roller and bracket in Sawyer & Purves, which absolutely wedges the disk and prevents it being turned back. The coin must therefore be delivered. Another form of fraud, the introduction of wires, etc., is now quite done away with, because in most arrangements the coin is used as a gag, and there is no part which can be operated except by it. As Mr. F. Livesey recently said, "The methods now adopted in the best meters will prevent tampering in cases where this evidence"—the money box—"is not forthcoming." The testimony of those who use large numbers of these attachments is proof of the fact that the best makers are now producing attachments which are substantially fraud-proof.

Accuracy of Action.—Dealing now with the other points laid down early in this paper, it will be seen that the mechanism used is now such that it is practically impossible for there to be any inaccuracy in the quantity of gas delivered for each coin. By means of special tools the parts are made with as much exactness as the index, and just as the latter is relied upon, it may fairly be presumed that the new attachment can be. The whole matter turns upon the character of the mechanism, and this, it will be seen, is very good. It is no part of the duty of the writer to select any specimen for special commendation in this respect, and it is only necessary to point out that the accuracy of the mechanism depends mainly upon its positiveness and directness. The universal employment of the coin as a gag implies that the moment pressure is employed the mechanism begins to act, and in like manner the direct gearing of the parts to the index mechanism involves the immediate reversal of what may be called the operative portion. It is only necessary to point out to a body of engineers that it may be taken as a general rule that the more positive, simple and direct the connection is between the parts which are relied on for doing either portion of the work, the more likely is accuracy to be attained. If that general statement is applied to any mechanism devised for this purpose, its relative merit can be easily ascertained. That this particular feature has not been lost sight of, and the necessary requirements fully met, is borne out by a statement made by Mr. Frank Livesey, who said recently: "With some meters the losses had amounted to 1¼ per cent. on the rental; but it must be remembered that the first ones issued were not so accurate as those now made. * * * The 1¼ per cent. includes many of these early pattern meters, and therefore it must not be considered as a permanent feature. There is, in fact, no reason to suppose that the losses on the prepayment system should be greater than the bad debts of the ordinary consumer." This statement has received confirmation from other users, and may therefore be taken as embodying the facts.

The two other features of strength and compactness might almost be left to the judgment of those who inspect the meters. Strength is, in most cases, amply provided for, and although not excessive, is, in the writer's opinion, sufficient for all practical purposes. So far as compact-

ness is concerned, none of the attachments can be objected to on that score, but if any one is chosen for special notice in that respect, it is that made by Messrs. Braddock.

Changing the Price.—The question of changing the extent to which the effect of the operating mechanism can be varied, so as to give different volumes for the same coin, is one to which undue importance may be attached. Although changes are made in the price of gas in any locality from time to time, they are not so frequent as to necessitate elaborate mechanism for the purpose. So long as the changes can be made conveniently without disturbing the meter, all that is required is done. It may be said that it is practically immaterial whether the effect is produced by varying the action of the parts which open the valve or those which close it. It is, of course, essential that the change be made with certainty, and, in the opinion of the writer, this can be done as effectually by means of change wheels, as in the Sawyer & Purves arrangement, as by the special device adopted by Messrs. Cowan. The matter is purely one of convenience, if looked at from the comparative point of view, and it is that which will probably decide the question, provided that the accuracy of the change is equally certain in each instance. It may, perhaps, be doubted by some one whether it is not easy for the consumer to alter the adjustment of the parts. To this it may be answered that the adjusting mechanism is inclosed in a sealed case, and that even if any such tampering took place it will be at once detected when the index of the meter is read and the amount there registered compared with the coins contained in the box. In Parkinson's attachment the limitation of the action of the coin is effected by adjusting the amount of rotation of the coin receiver, a principle which is observable in others. For instance, Cowan regulates the operative stroke of his pawl while retaining a uniform action of his pusher; and Sawyer & Purves also have a fixed action of the receiver, but vary its effect by change wheels. Braddock, on the other hand, depends on a variation of the rate of the return motion of the valve while uniformly maintaining the operation of the coin receiver. In the opinion of the writer it may fairly be said that gas companies have at their command attachments which fulfil all the requirements stated, and that there is little reason to expect either inaccuracy, undue cost for repairs, or liability to fraudulent use when they are employed. It is only necessary to say, further, that all the arrangements described have dials which show the quantity of gas paid for but unconsumed, and most of them also show the volume given for each penny.

Nothing has been said about another type of mechanism known as stop-index meters. These are, briefly, meters fitted with an adjustable arrangement which enables an inspector, on receipt of a sum of money, to arrange the index so that when gas of the required value has been passed, the meter will be stopped. In one or two cases this course is preferred, but the tide of feeling is setting in so strongly towards slot attachments that it will probably soon be abandoned. In any case there is nothing to prevent any slot meter from being made to use a shilling instead of a penny, as a slight change in the return gearing will effect the object. It is becoming more obvious daily that the real field for the employment of prepayment attachments is that enormous one existing among the poorer classes, where the democratic penny is in more request than the middle-class shilling.

Pushing the Coin Meter.—It may perhaps be of interest to detail the steps which are being taken by the various companies to induce the use of gas, and at the same time to introduce the prepayment system. This matter must not be confounded with a purely lighting scheme, as it will be shown that, while that side of the question has not been neglected, the use of gas can be encouraged in another way of almost equal importance.

Mr. Foulger, of the Gas Light and Coke Company, recently said, after explaining what that Company had done in the matter of a trial of prepayment meters for some few months, gave particulars of what they intended to do to encourage the use of gas. They proposed to introduce into houses within their district, at their own cost, plain pendants and brackets and a cooking stove, with their connections, but of course under a specific agreement with the owner. The cost of fitting will be from $35 to $40, and it is expected to recoup this outlay by the extra profits to be obtained from the gas sold. In that particular case a charge of 83 cents per 1,000 cubic feet is resorted to—equivalent to 25 cubic feet for each penny—or 12.5 cents per 1,000 more than the ordinary charge, the extra being relied upon to cover the interest on capital expended. The South Metropolitan Gas Company supply one pendant, two brackets and a small cooker at a charge of $27.93, and this expenditure is compensated for by an extra charge of 18 cents per 1,000 cubic feet, which it is expected will provide a sum giving an adequate return. Without going into many details on this special point, it may be said that the character of the fittings supplied is usually about that described above, and their cost varies from $15 to $40 according to the quality, about $20 being a usual amount. To compensate for that an extra charge per 1,000 cubic feet of from 8 to 16 cents is made, so that when it is remembered that in most cases the hire includes not only the gas meter but the fittings and a small cooker, it will be seen the charge is not an excessive one. It is obvious that this is a new departure and may have great consequences. Of course, its adoption involves an arrangement with the owner of the premises, as otherwise the introduction of the fittings will be attended with difficulty, but there does not seem to be any trouble in doing this. From the tenant's point of view the matter is an undoubted advantage. For a sum of from 25 cents to 37 cents per week, paid a few cents at a time, the cost of lighting and cooking is entirely met, even if four lights are used in one house, the cost in a smaller house being correspondingly less.

It is evident that the system has taken root, and that, to use an Americanism, it has come to stay. Wherever a trial has been made of it the results have been satisfactory for both parties. Thus, in Liverpool there are about 12,000 of these meters at work, the London gas companies are taking them by hundreds weekly, and the natural result is that the gap caused by the electric light is being filled, and more than filled. The experience of those who have been bold enough to try the experiment shows that a use of from 10,000 to 20,000 cubic feet per year may be looked for from each consumer, and how important the new departure may become is evidenced when it is stated that in Croydon the extra consumption thus obtained in 12 months is 16,000,000 cubic feet, or $\frac{1}{10}$ of the whole consumption. Further, the evidence available shows that the tendency is for the consumption to grow after the system is adopted, and it is perhaps worth noting that where the most liberal policy is pursued there the greater use is made of gas. In a short space of time it will be found that by the adoption of the system, not only will the light be brought to the houses of the very poorest, but it will be so brought at a profit to the company or corporation supplying it. It may be stated as a curious fact that it is to the private gas companies rather than to corporations that the development of this system is due, the stimulus of possible profit being apparently much stronger in the one case than in the other.

In concluding this paper the writer wishes to express his thanks to the numerous firms who have enabled him to exhibit their attachments, and thus make the subject more interesting. It has not been possible to describe or illustrate every prepayment attachment which is on the market, but those which have been dealt with may be designated the best known, most of them being in extensive use. It is, in the writer's opinion, well established that, considering the short time the mechanism has been required, the mechanical skill of the various makers of meters has enabled them to produce attachments of a high degree of merit and effectiveness. Considering what is required of them, the attachments are simple, and in this, as in other things, it is shown that an established need has not to wait long to be met by the exercise of the skill of the engineer and mechanician.

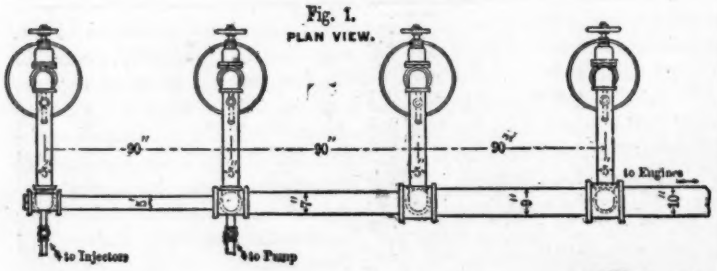
Are There Certain General Principles Underlying the Proper Connection of Steam Boilers and Engines in a Power Plant?

By Mr. Theo. F. Scheffler.

Too much cannot be written about the design or construction of boiler and engine plants, either for electric light stations or for power plants, or, in fact, for any kind of a power station. Considerable space may be saved by leaving everything to the manufacturers, as well as economy secured in pipe connection. There certainly is a method for setting the engine connected to the boiler so that the best results may be obtained. For small plants, where there is but one boiler and engine, it is customary to set the engine about 12 feet to 14 feet from the boiler, and put an 8-inch division wall between the boiler and engine rooms, so as to keep all dust accumulating from ashes out of the engine room. For the best results, engines should be set longitudinally with the boiler so that direct pipe connections can be made. This is also, in the writer's opinion, the best method on account of the expansion of the steam pipe. In plants where there are three or four engines to be connected to a battery of boilers, and the engines are placed either directly in the rear, or in front of the boiler fire room, there will be considerable waste of steam pipe, which will amount to quite an item on account of the steam pipe being large in diameter to accommodate the volume of steam from the boilers to the engine.

For the purpose of having some fixed basis to work from, the writer has taken for an ideal plant the following specifications of boilers and

Fig. 1.
PLAN VIEW.



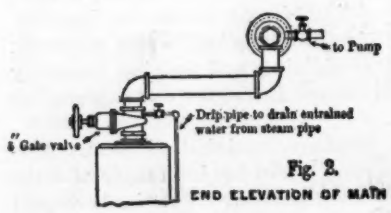


Fig. 2.
END ELEVATION OF MAIN STEAM PIPE.

Fig. 4.

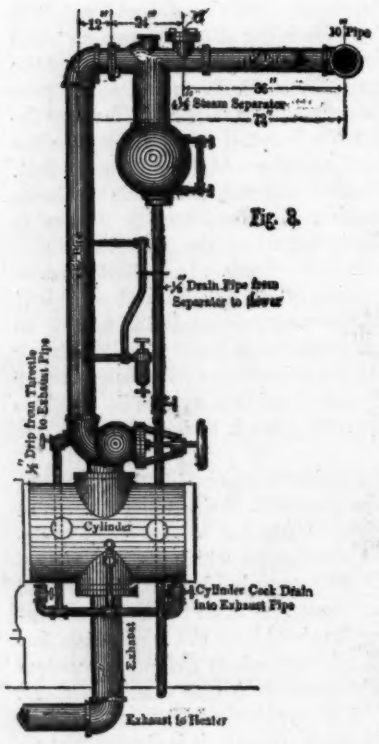
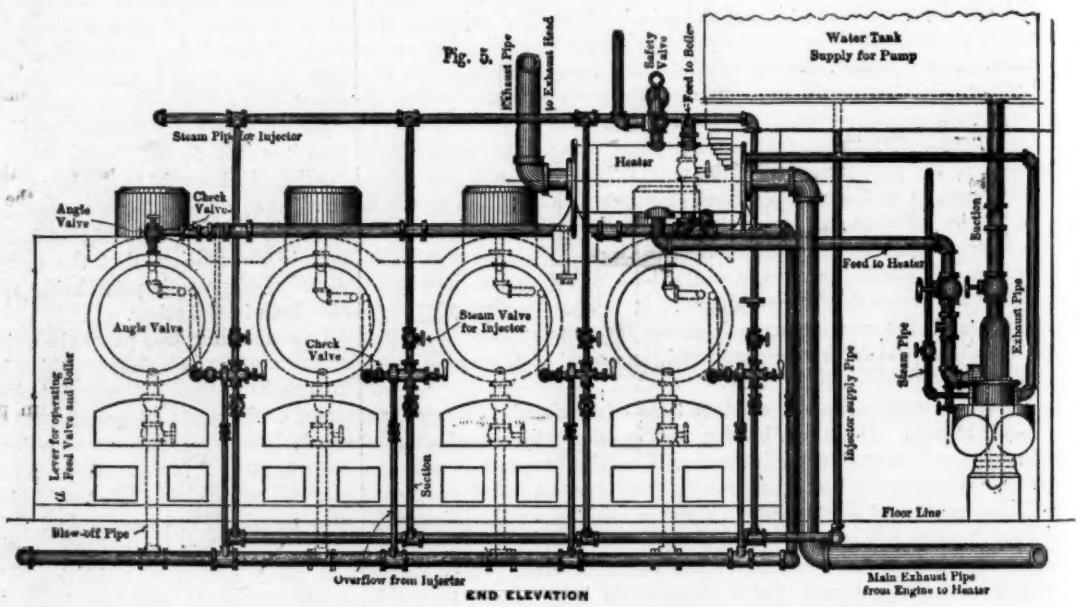


Fig. 3.

Fig. 5.



END ELEVATION

engines, and the necessary items to make a complete and modern steam plant.

Boilers.—Four 66 inches × 16 feet horizontal tubular boilers, rated at 100-horse power each, and to be set in one battery with full arch fronts, and all necessary fittings, such as safety valve, steam gauge and siphon, water gauge with stand pipe fitted to boiler, then gauge cocks for each boiler, blow-off valve, two check valves, two stop valves for feed pipe, main gate valve for steam outlet, rocking grates, grate bearers, stack plate, rear arch bars and rear ash door and frame. These fittings go with each boiler. One boiler cleaner for all four boilers.

Engines.—Four 13 inches × 12 inches non-condensing, high speed automatic engines, to develop 90 indicated horse power each; diameter of steam pipe, 4½ inches; diameter of exhaust, 5 inches; diameter of pulley, 54 inches; face of pulleys, 12½ inches, with complete set of fixtures, such as throttle valve, large size sight feed lubricator, full set of sight feed oil cups, and automatic oiling devices for crank pin and cross head pin, wrenches, crank shield, cylinder cock drip connection for steam chest, foundation bolts, and one 4½-inch steam separator for each engine; feed water heater to be 42 inches diameter with 100 2-inch tubes 60 inches long. Engines to set 9 feet, center to center and longitudinally with boiler. Pump required for this plant, one 400-horse power pump, or a pump capable of delivering 3,000 gallons per hour, and all necessary pipe connections. Each boiler to have one injector of 100-horse power capacity, or equivalent to forcing 800 gallons of water per hour into boiler, and all necessary fittings.

In a plant of this size it is customary to use a feed water reservoir tank. Where there is no city water pressure the tank is supplied with water by a pump, the tank being suspended above the boilers, so that the water will flow by gravity to the boiler feed pump, thereby keeping the pump valves flooded with water. One exhaust head should be connected to the main exhaust pipe after leaving the feed water heater.

Probably right here would be the proper place to say a few words in connection with the engine foundations. The depth of engine foundation should be at least 6 feet, unless there is a good rock bottom found before reaching this depth, so that the engine anchor bolts may be anchored directly into the rock; otherwise, if there is no such rock to anchor to, and the above depth has not been made, there will not be enough weight to the foundation to hold the engine down. The writer is well aware of the fact that there are engines on the market to-day where great care and attention have been given thoroughly to counterbalance the engine, so that the engine will run steadily and smoothly, set upon four pins, and will not jar or shake off the pins, the engine not being bolted to the foundation. The above is all right so far as it goes, but will not answer for large engines, and especially when the engine is very heavily loaded. The length of the foundation on the shaft end of the bed, measured from the center of the shaft to the end of the foundation, should be equal to the length of the foundation measured from the cylinder end of the bed to the center of the shaft. The correct proportion for this length of foundation is about 7½ times the stroke of the engine.

In a great many cases this length of foundation on the shaft end of bed has been very much diminished. There is no better place to throw in brick on an engine foundation than on the shaft end; here is where the weight is required.

FIG. 6.

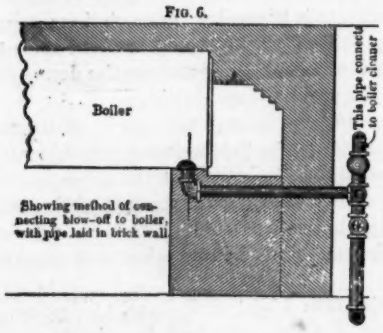
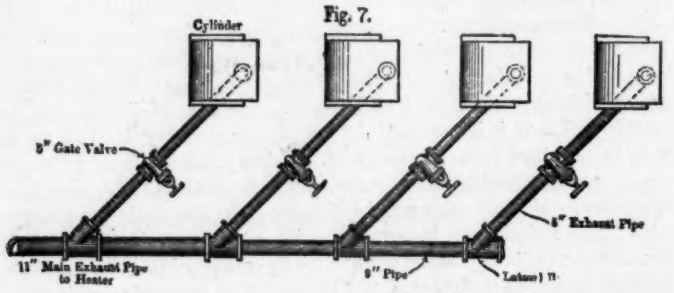

Boiler
This pipe connects to boiler cleaner
Showing method of connecting blow-off to boiler, with pipe laid in brick wall

Fig. 7.



The above dimensions which have been given will make the ends of the foundation equally divided on each side of the center line of the shaft, making the center of the shaft in the center of the apex of the foundation. The width of the foundation at the bottom should be equal to eight strokes of the engine. In this case, the stroke of the engine is 12 inches, multiplied by 8 inches, which would equal 96 inches. The number of brick which would be required for this foundation is 7,500.

Having found the proper dimensions of the engine foundations, it will be as well to give thought to the relative proportions of the boiler foundation and settings. The writer has found by experience that 3 feet deep will be sufficient for this size of boiler below the floor line. A good, hard sandstone will give good results when brick is not used, which some people prefer. The width of the foundation should be 6 inches more on the floor line than the boiler side walls, which, in this case, should be 24 inches wide. There has been considerable argument about the best height from the floor line to the fire door opening; 22 to 24 inches is a very satisfactory height, but 30 inches is considered much more satisfactory and better adapted to the ordinary fireman. This height has been obtained for these boilers by raising the bottom of the fire fronts 6 inches above the floor line, as the height of opening is but 24 inches in the casting. This method of raising the front has proved very satisfactory wherever it has been adopted. Another point to be considered on these boilers is the height from the top of the bridge wall to the under side of the boiler shell. The height in this case is 12 inches, and this gives an area between the top of the bridge wall and the bottom

Fig. 8.

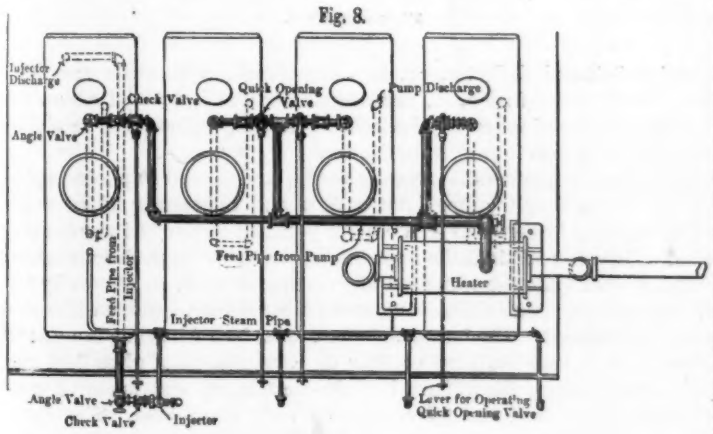


FIG. 9.
Showing arrangement for connecting Boiler Cleaner to Boiler

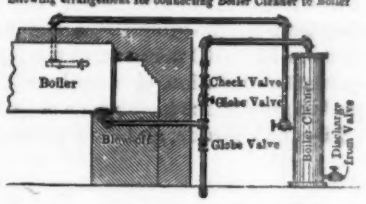
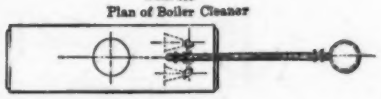


FIG. 10.
Plan of Boiler Cleaner



side of the boiler shell of 1,550 square inches, which is equivalent to double the area of the boiler tubes. For the best results in combustion and efficiency this height has proved to be very satisfactory. The bridge wall should be made horizontal on top. Some manufacturers recommend the top of the bridge wall to follow the curve of the under side of the boiler shell with the necessary area between the bridge wall and the boiler. Another good point for consideration is the distance from the top of the grates to the bottom of the boiler shell; in this particular case it is 26 inches. This height has proved to be very satisfactory. Of course, there is a wide range of opinion on the height; some manufacturers prefer but 23 to 28 inches and some even prefer 30 inches. The writer has found this height to suit in almost every possible case. The height given is about the average, and will evaporate more water than if the height was 30 inches.

The boilers and engines having been set up on their foundations, the next point in view to consider is the main steam pipe and fittings. (See Fig. 1 for illustration of the main steam pipe.) We will first consider the correct diameter of the main steam pipe. As we have in this case four steam outlets from the four boilers, one from each of the boilers, and, as the commercial diameter of each pipe is 5 inches, we shall require a main steam pipe with an area equal to four times the area of the 5-inch pipe. The area of a 5-inch pipe is 19.63 square inches. This multiplied by 4 gives 78.52, which is equivalent to a pipe 10 inches in diameter. The pipe is constructed on the telescopic method, that is, the diameter of the pipe from the first boiler to the second boiler is 5 inches; from the second boiler to the third boiler, 7 inches; from the third boiler to fourth and last boiler, 9 inches; and from the last boiler to the engines the diameter is 10 inches. This pipe will carry all the steam which the four boilers can supply and with a minimum resistance. Observing the end elevation (Fig. 2), the main steam pipe is at the extreme height. This arrangement allows of all condensed water flowing back towards the boilers.

There should be a drip connection placed on the gate valve just above the valve seat, so that condensed water may be drained off. By this arrangement of drip pipe, considerable water may be saved from getting into the engines. It will also prove to be economical and saving of steam from the boiler after the gate valve is opened; for, if this accumulating water is not let out at the boiler after any one of them has been shut down, the steam will condense very rapidly. Of course, this is only a small saving of steam.

The main steam pipe is located 36 inches from the center of the dome. This is done so that when the steam pipe expands or contracts, it will not make any strain on the screwed connection at the point marked *A*, but will naturally swing from the center of the dome, the center of the dome becoming the fulcrum of the main steam pipe. The steam pipe connections for the engines are made in the following manner (Fig. 3): First, a short piece of 4½-inch pipe is connected to the main steam pipe and then to the steam separator. The steam taking a spiral course inside the separator, causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to the center of the pipe. When it is not convenient to pipe up the separator as shown, steam may be taken into the separator at *A*. For sectional view of separator, see Fig. 4.

The separator should be located as close as possible to the engine, so that nothing but clean, dry steam will be supplied to the engine. The main steam pipe is located 72 inches from the 4½-inch vertical steam pipe, which is connected directly to the engine throttle valve. This allows the 4½-inch horizontal steam pipe connected to the separator to swing from the elbow *B* when expansion or contraction takes place. Fig. 3 also shows the exhaust pipe connected to the cylinder; for continuation of exhaust pipe, connected to feed water heater, see Fig. 5.

The best and usually the most convenient place to locate a feed water heater is on top of the boiler side walls, placed at right angles to the boiler and set horizontally, the heater being supported at each end by a cast iron leg or bracket, and each bracket anchored into the boiler side walls by anchor bolts.

This method of locating the heater has been, as described above, placed on several large boiler settings which the writer has designed. Any person who is in any way familiar with boiler settings knows how hot it is over the top of boilers, and can readily see the advantage of locating the feed water heater above the boilers. From 5° to 10° of additional heat will thus be obtained for the feed water over that supplied, if the heater is set up, as is common practice. To set the heater on top of the boiler will cost a little more, but it will soon pay for itself by being economical.

The injector should have a separate feed water pipe, on entering the boiler, so that in case any accident should happen to the pump pipe connections, or repairs should have to be made on the pump or to any of the connections, there will be no loss of time by having to draw off the steam from any of the boilers, in order to make the necessary repairs. If necessary, by closing the main feed water pipe valve connected to the pump line of pipe, after the water is forced through the heater, and by closing the feed pipe valve over each boiler, the whole line of pump pipe connections may be disconnected, and the boilers fed with the injectors. A check valve should be placed over each boiler for the feed pipe, and also between the pump and heater. This will keep all pressure away from the pump and will be beneficial in case anything should happen to the boiler checks. The blow off from the heater is connected to the main blow-off pipe, as well as the overflow from the injectors, and the discharge may be connected to any convenient point which will be the nearest at hand, or may be carried to the sewer. To operate the blow-off on the boiler or heater, the globe valve on the injector pipe should be closed. The injectors are supplied with water from the water tanks overhead; this will give a constant supply of water under a head of water at the injector.

The main steam supply is connected to the main line of steam pipe leading to the engines. The idea of doing this is in case anything should happen so that any one or two of the boilers should be off duty, the supply of steam would be constant, in taking steam from the main line of steam pipe. A good way to connect the blow-off pipe to the bottom of the boiler shell and keep the pipe intact from burning out, is to build a small wall of firebrick, about 9 inches thick, and lay the pipe in the center of the brick. This wall will not diminish the area of the combustion chamber enough to destroy any of the draught. For illustration of this pipe connected to boiler, see Fig. 6.

The exhaust pipes leading from the engines to the main exhaust pipe should be constructed so that there would be a minimum amount of back pressure. To do this satisfactorily and with the best results, a lateral branch "*Y*" connection should be made where the pipe meets the main exhaust pipe. For an illustration of this design, see Fig. 7. A valve should be placed on the pipe leading to the main exhaust pipe, so that in case any one of the engines is stopped for repairs, the exhaust steam from the other engines would not back up into the steam chest, in case the valve on the engine was disconnected from the engine. The Y-connection also does away with the short and sharp angle connection and makes a freer passage for the steam.

Referring to Fig. 8, we have a plan view of the pump feed pipe connections with fittings, also the injector connected to the boiler. It will be observed that the injector pipe runs nearly the whole length of the boiler and toward the rear before discharging the water directly into the boiler. The advantage of this is apparent. The feed water becomes well heated before discharging into the boiler, and its chilling action on the shell is greatly lessened. There has been considerable discussion about where the feed water should enter the boiler, and the writer believes that this method is freer from objection than any other which could be selected. The pump feed enters the boiler at one-quarter of the whole length of the boiler, at the rear, and the pipe is kept as close as possible to the boiler shell, so that there will be room enough for a man between the pipe and the top of the tubes. The pipe then continues ahead about 8 feet and then turns towards the boiler shell on the side, and then turns and comes back where it started from and discharges downwards. Some persons may say there are too many turns employed in this method, but the feed pipe is made much larger after it enters the boiler to reduce the resistance caused by friction to a minimum. Fig. 8 also shows a plan of the feed water heater.

Figures 9 and 10 illustrate the method for connecting the boiler cleaner to the four boilers. The reservoir for receiving all of the sediment collected from the boilers is located centrally between the four boilers, in the rear. The action of the boiler cleaner is here described. As the water boils and circulates towards the top and rear of the boiler, the scoops gather all sediment which rises to the surface of the water and is then discharged by the boiler pressure into the reservoir. The water and steam may be let out of the boiler, independent of the boiler cleaner when it is necessary, by closing the valve connected to the boiler cleaner and opening the valve connected to the blow-off pipe proper. There is a globe valve attached to the bottom of the reservoir, where the sediment which has collected may be let out. This sediment should be let out every other day.

The writer desires to say, in conclusion, that about 20 plants have been connected up as described in this article, although they have not all had boiler cleaners, nor has the injector been connected separately to the boiler, and the engines and boilers were arranged somewhat differently in the setting; but all are giving good satisfaction, and the piping in general was arranged as described here. Further, in regard to piping in general, in case of any accident to any part of the plant, the part which is crippled may be shut off without shutting down the whole plant.

The steam will reach the engine with but little drop in pressure, as all pipes are covered with an asbestos air space covering.

Much more can be written on this subject and on this same plant; and the writer desires to say that some time in the future it would be interesting to give an approximate estimate as to the cost of the entire plant.

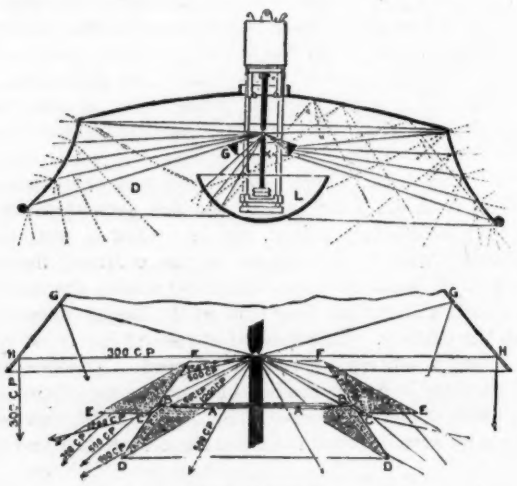
Distribution of Light from Arc Lamps.

Mr. Rankin Kennedy in discussing this subject says:

The light is thrown out from the arc in a continuous current circuit, principally in the form of a cone having its apex at the arc and its base resting on the ground; this is a favorable circumstance, and is taken advantage of to the fullest extent in street lighting by arc lamps.

For interior illumination the lower carbon is sometimes made the positive carbon, and the cone of light thrown up onto a white ceiling, or a white disk above the lamp—a method first used at the 1880 Paris Exhibition by Jasper, in lighting the art gallery.

An arrangement by Siemens & Halske, for the same purpose, consists of a diffuser hung over an ordinary lamp. This diffuser is like a reflector in shape, and is about 3 feet 6 inches or 4 feet in diameter at the mouth, and is painted white inside. (*D*, Fig. 1).



Figs. 1 and 2.

A bowl-shaped deflector, or, in other words, a common enameled iron bowl, white inside, *L*, is hung below the lamp and serves the double purpose of reflecting the light up into the diffuser and receiving any ash or carbon falling from the arc.

Such an arrangement is so far quite old, and is used in photographic electric lamps by Gwynne. But a new and interesting addition for street lighting is shown at *G*, a ring of polished glass of triangular section. This ring receives the most intense cone of light from the arc, and deflects it onto the white surface of the diffuser, as shown by the divergent lines; with this arrangement a beautifully uniform illumination is produced. The lamp, of course, must be a focussing lamp; the glass ring is best built up of four or six segments of glass held in a light metal frame; the diffuser is umbrella shaped, and made of canvas on a wire frame, and painted inside with white lead. The whole arrangement is light and cheap, and easily applied to any focussing lamp.

An arrangement like this is far more rational, and superior to the insane practice of using semi-opaque globes over arcs in street lighting; these simply cut off from 30 to 60 per cent. of the light produced, and do not in any way assist the diffusion or distribution of the light. It can never be accepted as good sense to generate at great expense a powerful light of, say, 600-candle power, and then to carefully cut off 200

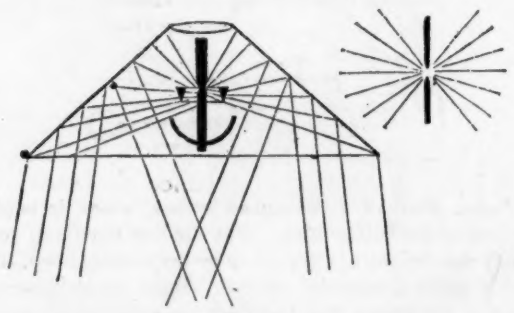


Fig. 3.

candle power of it in absolute waste, yet that is what is done in every arc lamp with a semi-opaque globe on it.

In this arrangement (Fig. 1) the arc is about 8 or 9 inches from the upper surface of the diffuser, which is, altogether, about 18 inches deep.

Prof. Anthony, who is a prominent authority on arc lighting in America, proposes another scheme for distributing light from arcs. Fig. 2 illustrates his method. Two rings of glass, *A*, *B*, *C*, *D*, *E*, *F*, of cross section, shown fixed with the arc on the level of the upper edge *H*, *G*. *H*, *G* is a reflector above the arc, which receives the upward thrown light and sends it to light up the space immediately below the arc. By

means of the prisms the strongest rays are sent furthest off, as will be seen by following the path of the 1,200-candle power ray in Fig. 2.

This is rather an elaborate arrangement, but still, as it would give at least four times more light, evenly distributed, compared with the semi-opaque globe, it may be cheaper in the end to use it. The idea is not to waste about half of the light in an endeavor to soften it, but to screen off the actual light and diffuse or reflect it from a large white surface. An alternating current arc requires a very different form of rings of glass, and also a different form of diffusing surface. A plain cone is best for this purpose, as the light is thrown from the alternating arc in a diverging ring as in Fig. 3.

The usual arrangements of large diffusers are very hideous looking affairs, but where arc lighting is to be adopted on any large scale it is easy enough to make them both effective and artistic with the aid of the architect.

Some Suggestions for Engineers' Specifications.

Some recent experiences prompt us in making two suggestions which should be specially considered by engineers, as well as by boiler makers.

We have yet to see a specification for boilers, stand pipes or kindred work where the physical requirements varied with the different thicknesses used. This is most notable in stand pipes or tanks which begin at the base with thick plates and decrease, course by course, as the top is reached. For example, on a large stand pipe which we recently furnished, the lower course is $\frac{3}{4}$th inch thick, and gradually lessens to $\frac{3}{16}$th inch at the top. And yet the same physical qualities were named for the entire order. No mill can, of course, furnish such an order without making a separate lot of steel for each thickness of plate used, nor is this at all necessary. The remedy is for engineers to make their requirements apply to one particular thickness which may be regarded as standard, and a certificate be obtained, if necessary, from the manufacturer, stating that the balance of the material used was from the same heat. Or, if tests on the balance are desired, there should be a fixed allowance for variation of tensile strength, elongation, etc., where the plates are thicker or thinner than the standard thickness.

Another suggestion which the collapsed stand pipe at Peoria, Ills., brings to mind, is the advisability of reaming out all punched rivet holes in heavy material, especially in the lower grades of tank and cheap flange or shell steel. By heavy, we mean $\frac{1}{4}$-inch and thicker, and in some instances it would be well to treat $\frac{3}{8}$-inch the same. We can imagine a thick plate of steel made up of layers like a block of paper. One or several of these sheets can be penetrated close to the edge without tearing the material. But an effort to force an instrument through the entire mass would puncture or break out the edges. So with steel plate, a long used or dull punch strains the steel in the rivet hole, more in a thick plate, less in a thin one. This strain tortures the material, which, under a magnifying glass, is shown by little veins or fractures radiating out from the rivet holes. By reaming out the metal, say $\frac{1}{16}$th inch, this injured metal would be removed, and the tendency to fracture destroyed. The United States Government allows 20 per cent. more pressure on marine boilers where the rivet holes are drilled, than if punched. The additional cost of reaming punched holes is a trifle compared with the removal of an element of risk inseparable where punched sheets are used. There is no shop so small but it has a drill press, so permitting this operation without inconvenience. The best boiler makers and engineers do not deem reaming necessary on light plates—*i. e.*, $\frac{5}{16}$th inch thick and less.

The Electric Problem with Reference to Fires and Firemen.

By Mr. G. P. Lowe, Electrical Inspector, San Francisco.

Those features of the use of electricity which are of concern to firemen may be summarized in general as follows:

First—Electricity as a fire producer.

Second—Electrical appliances as an interference with the duties of firemen in combating fires.

Third—Electric light and power stations, telephone and telegraph offices, and fires therein.

Fourth—Impairment of the water mains by electrolysis.

Fifth—Electricity in the fire department service.

Considering these features collectively, there is no reason for doubting the broad assertion that the hazards to life and property from the manifold applications of electricity are overbalanced a hundredfold in the single boon that is conferred in the fire alarm telegraph. If electricity uncontrolled has cost millions of dollars and human lives by the score, no one can enumerate the billions in property or the thousands of lives that electricity controlled has saved through averting widespread conflagrations. Let us, then, be magnanimous in judging the characteristics of this marvelous energy, for it is by far a greater friend than foe.

Broadly speaking, every fire caused by electricity may be properly attributed to improper workmanship or to indifferent care, from which arise several potent hazards. Water is as liable to cause fire from electric circuits as it is with quicklime. Every possibility of moisture reaching electric wires or apparatus must therefore be provided against, and it is for this reason that rules for safe wiring so often contain such clauses as "located in a dry place," "provided with a waterproof covering," "kept free from moisture," etc. The overloading of a circuit—that is, the crowding upon it of a greater current than it should carry—is not so prolific a cause of fires in incandescent lighting circuits as is generally supposed, principally for the reason that through the use of safety devices serious overloading has become an extremely rare occurrence. Moreover, overloaded circuits do not give a satisfactory light. Again, in arc lighting, the current carried is so slight that the smallest size wire used in electric lighting will safely carry it without material heating. It will appear singular that the arc current, despite its small heating ability, produces more known fires than any other form of circuit. The cause for this apparent anomaly is that arc lighting circuits are operated at high electric pressures, which are difficult to restrict, that their insulating covering suffers deterioration from exposure to the weather, and that they are almost universally carried in and out of buildings through or around awnings and cornices. They are therefore easily interfered with, and their maintenance is very difficult. Arc lamps are nothing more and nothing less than open flames which sometimes throw off glowing sparks of carbon dust, white-hot flakes of carbon, or red-hot globules of molten copper. Treat them accordingly. Keep ignitible material from around and under them, and the lamps themselves will be rendered safe from fire.

The crossing of arc, trolley or other aerial wires with telephone or telegraph wires produces heating in the delicate telephone or telegraph instruments, that not only chars them badly but frequently causes serious fires. The best cure for this class of fires rests in the use of strong current protectors.

A most serious phase of the electrical problem is the manner in which the erection of pole lines of aerial wires interferes with the duties of firemen. The interference is dual in its nature. It is physical in that the wires present an actual barrier which must be overcome with force and it is moral in that the men are naturally fearful of the consequences of handling circuits, the character of which they do not understand. No one need hesitate to cut telephone, telegraph or other signal wires bare handedly, for if you receive several "surprises" they will startle you but will do no harm. No one need expect to be killed if he cuts a trolley wire or a whole set of railway feed wires. If you stand on a ladder of dry wood and which is not metal bound, and if it is not raining and you have no connection with the earth through metal or moisture, you may hack away at the trolley wire with perfect impunity and a dull ax. In fact, it alone is as harmless as the car rail, for the trolley forms one pole of the dynamo and the car rail forms the other. So long as only one is touched at the time they are without danger. But should you, by any means, through dampness or metal become connected with the earth while handling a trolley wire, you would get a "rap" that might double you up, or it might be so light that ample solace would be had in mild profanity. Of this, however, you may feel assured; if you are robust, no shock you may receive from a trolley circuit will of itself kill. It might knock a man from a ladder and the fall might prove fatal, or if a man had heart disease he might not survive, but I have never known of an instance where the "deadly trolley" has of itself proved fatal.

With arc lighting and alternating current wires, both of which are operated at high pressure, it becomes a matter of no little hazard for a layman to cut them, particularly if wet. It is advisable that they should be handled only by an experienced lineman. Such wires are always "hot," and not only work with each other, but each with the earth.

With reference to fires occurring in electric light and power stations and in telephone and telegraph offices, I beg you to most carefully consider the fact that water is almost, if not quite, as fatal to most forms of electrical apparatus as is fire and that, therefore, in combating fires in such premises the utmost discretion must be used in throwing water. The necessity for this is all the greater for the reason that the stream of water may take any pressure electric current and carry it to the nozzlemen with probably fatal results.

A fire that occurred in an electric light station in a large eastern city

several months ago entailed a loss of about $16,000, of which amount only a few hundred dollars was lost by the fire itself and the remainder was due to the wetting of electric equipment, which caused the current it carried to consume it. The use of the garden hose for five minutes in the main operation room of the San Francisco Telephone Office would entail a loss running into tens of thousands, and telegraph offices, though not equipped with such expensive apparatus, are almost equally sensitive to water. I would strongly advise that water should never be used except as a last resort, and even then, if possible, it should be with the sanction of the station superintendent, who will at least indicate the location of the wires or apparatus carrying electric pressures that may prove fatal. Above all, fire chiefs should familiarize themselves with such stations as are in their jurisdiction, and should ascertain from those familiar with electricity those portions of the installations that are most costly and most sensitive to both fire and water; you may thus acquire that discretion which it is necessary that you must evince in handling fire in this supersensitive form of apparatus.

The fifth and last feature of the applications of electricity worthy of your consideration is its use in fire department service. Fire alarm systems are, I understand, to receive special attention from one well qualified to discuss them, but I would feel remiss did I not offer a word in reference thereto. Your earliest experience with electricity came with the use of the fire alarm telegraph. It quickly ingratiated itself into your esteem, and you soon found it to be indispensable. Beyond this, in the automatic fire alarm is presented a system that not only is impossible of failure, but which automatically discovers the fire and rings in an alarm therefor with absolute reliability. The perfection which automatic fire alarms have attained is marvellous, and the benefits accruing therefrom are so immeasurable that every exertion and reasonable concession should be made to secure its introduction and use. Among other things, the rules of the Pacific Insurance Union for the installation of automatic fire alarm service require that the system shall be able to transmit an alarm of fire under all circumstances, even if the line wire is broken. If the system gets out of order from any cause it must give ample warning thereof and yet ring in automatically a faithful alarm for any fire that may occur. It must, moreover, invariably thwart malicious interference by any layman and call attention to the fact of such attempted interference. These stipulations are not only required, but they are actually carried out. Such a system is more than human. Man may perceive and act, but he is but mortal and may fail. As the breath of life was breathed into the form of clay, so is the unfailing mechanism of the automatic fire alarm telegraph endowed with the marvellous force of electricity. Nature's most subtle energy courses through its veins, and sleepless, tireless, unfailing, it ever guards its vigil—for the laws of nature never change.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

INDIANA capitalists are said to be endeavoring to secure control of the plant and franchises of the Dayton (O.) Gas Light and Coke Company, which desire is little to be wondered over, for the Company has enjoyed at least a fair share of prosperity since its organization in 1848. And it might be further said that its present owners are well aware of the true value of the property. The Messrs. Murdock, well known in connection with Indiana gas matters, are amongst those interested in the negotiations to secure the Dayton plant.

THE City Council, of Brookfield, Mo., has granted a franchise to Messrs. W. P. Monroe, F. A. Tucker and John McGlothlin for the right to construct and operate a gas plant in that city. The provisions of the franchise give the city the right to name the streets in which the mains shall be laid, provide that the plant is to be completed and 6 miles of pipe laid within one year from the signing of the franchise, and stipulate that the maximum gas rates are not to exceed the following:

Monthly Consumption.	Rate, per 1,000 Cu. Ft.
100 to 1,000 cubic feet	$1 75
1,000 to 2,000 "	1 50
2,000 to 3,000 "	1 35
3,000 to 4,000 "	1 20
4,000 to 5,000 "	1 10
5,000 and over	1 00

The promoters say they will expend $50,000 on the plant, and that work will be commenced by January 1st.

BROOKFIELD is a part of Brookfield Township, Linn county, Mo., and is on a stream know as Yellow creek, at a point 104 miles west of Hannibal and 26 miles east of Chillicothe. The Hannibal and St. Joseph, and the Burlington and Southwestern railroads pass through it. It is a very thriving place and has a population of perhaps 7,000. An excellent quality of bituminous coal is mined in its immediate vicinity.

AN order for the voluntary dissolution of the Brockport (N. Y.) Electric Company has been issued by the proper legal authority, and Mr. J. D. Burns was appointed receiver. Lack of remunerative business was the cause of the failure.

AT the annual meeting of the Citizens Gas Company, of Willimantic, Conn., the summary of the business done was satisfactory to the shareholders. A 3 per cent. dividend was declared, and the following officers were chosen: President, General E. S. Boss; Secretary and Treasurer, O. H. K. Risley; Superintendent, General Manager and Purchasing Agent, Edwin Evans.

THE report of Mr. William C. Adams, Superintendent of the Richmond (Va.) municipal gas works, for the month of November, shows a make of 20,224,500 cubic feet. The make for the corresponding month in 1893 was 20,050,300 cubic feet.

THE proprietors of the Coatesville (Pa.) Gas Company are having a discussion with the local authorities, which will likely be terminated in the courts. The cause of it all is the refusal of the Company to accept as legal and binding an ordinance passed some time ago by the Council to the effect that anyone "who should, for any purpose whatever, tear up the macadamized streets of the borough," should be called upon to pay a fine of $1 per day, "until the surface of the street disturbed had been restored to its original condition." The Company claims that it is permitted by its charter to open the surface of any street, without any restraint save that the work of repair shall be completed within a reasonable time.

WE understand that the Hollidaysburg (Pa.) works have changed hands again. Mr. J. E. Shatzer, the former Superintendent, has accepted a position to manage an electric street railway system at Pottsville, Pa.

THE death of Mr. Spofford P. Thomas, of Ellsworth, Me., which occurred on the 3d inst., marked the demsie of a man who for 50 years or more was a prominent figure in the business interests of that place. When the Ellsworth Gas Company was incorporated, and on the completion of its works (about 1870), he was appointed Superintendent thereof, which position he held until the enterprise was amalgamated with the local electric lighting concern, the proprietors of the latter furnishing the money for the purchase, and consequently dictating the policy to be pursued. He was in his 79th year. Interment was made in Woodbine Cemetery, Past-Master John B. Redman, of Lygonia Lodge, of which body deceased had been a prominent member, conducting the funeral services.

WE are indebted to "Observer" for the following: "The members of the Massachusetts Board of Gas and Electric Light Commissioners are kept very busy these days. Almost every day they have hearings on petitions and appeals from various parts of the Commonwealth. Chairman Barker and his colleagues find their time quite taken up by investigations connected with the business of the Commission which has been imposed by statutory regulations. On the 5th inst. the Commissioners were at Rockport all day, listening to the appeal of the Gloucester Electric Company from the action of the Selectmen allowing the Rockport Electric Light, Heat and Power Company to come into the field as a rival. It was an unusually important case, involving many intricate questions of law. On Thursday, the 6th inst., the Commissioners went to Wakefield and gave a hearing on the petition from the Municipal Light Board, asking approval by the Commission of the prices which have been fixed by the Municipal Board for the lights sold by the town. On the same day the Board granted permission to the Milford Electric Light Company to issue bonds in the sum of $24,500; and on the following day a hearing was given on the application of the Gardiner Gas, Fuel and Light Company for leave to issue new stock. On Tuesday, the 11th inst., a hearing was had on the application of the Attleboro Electric Light Company for permission to issue new stock. On Thursday morning, the 13th inst., they heard the arguments on the petition of the Edison Company, of Fall River, for permission to increase its capital; and on the afternoon of the same day the petition of the Northampton Electric Light Company for a similar permission was taken under advisement. On December 17th the Commission will hear argument on the petition of the Natick Electric Company for permission to issue $250,000 stock and bonds. On the 18th it is on the cards that the hearing on the application of the Brookline Gas Company for per

mission to increase its capital stock will be continued. All of which goes to show that the Commissioners are earning every cent of the decidedly meager salaries paid to them under the provisions of the act."

THE offices of the American Instititute of Electrical Engineers, which have been at 12 West 31st street, since May, 1890, have been removed to rooms 1009 and 1010 Havemeyer Building, 26 Cortlandt street, New York. The open hours are from 9 A.M. to 5 P.M., and the Institute's clever Secretary, Mr. Ralph W. Pope, will usually be on hand to greet the visitors. The meetings of the Institute will be continued at the 31st street house until further notice.

IT is said that a Company to supply gas to the residents of Waterville, Maine, is about to be formed. This place, which is on the west bank of the Kennebec river, can be reached by the Maine Central Railroad, and is 18 miles north by east of Augusta and 80 miles north-northeast of Portland. It is the seat of Colby University (formerly known as Waterville College), and is peculiarly well situated as a manufacturing center, several falls (the most notable of which is Ticonic Falls) affording ample, reliable and cheap power. The Kennebec river is navigable to Waterville, and the township has a population of about 6,000.

THE plant and franchises of the Capital City Railway and Lighting Company, of Baton Rouge, La., are to be sold at auction on an execution of judgment obtained by the Bank of Baton Rouge, the holder of certain mortgage notes.

IN this issue the P. H. & F. M. Roots Company, of Connersville, Ind., illustrate in their standing advertisement an improved gas exhauster, of recent design and construction. The cut clearly explains this new machine, and from appearances the apparatus seems to bear out the manufacturers' claim that it is a decided step in advance of all their past efforts. On all of the improvements shown the proprietors have secured letters patent. The stuffing box is so arranged that new packing can be inserted at any time while the machine is in operation—the "follower," is split, thus making the operation of renewing the packing very simple. The journal box which the Company use in their new exhausters, according to their claim, is superior to anything of the kind ever before used. The bearings are sectional and are so arranged that the alignment of the machine can be kept perfect during its entire lifetime. This is certainly a very valuable improvement in such machines—in fact, the Company claim it to be the only perfect bearing for rotary blowers or exhausters. The Company have also designed a new steam regulating valve for their gas governor, and now assert they build the most perfect governor on the market. In view of the 35 years' experience of the Roots' Company, their statements that these improvements are in advance of all their past efforts carry a great deal of weight.

THE South Framingham (Mass.) Gas, Fuel and Power Company, reports that it is placing a great many Welsbuch burners.

THE regular meeting of the Board of Supervisors of Poughkeepsie, N. Y., was opened "with prayer" by the Reverend Wayland Spaulding on the 6th inst., and it was thereafter suggested by Mr. Frank B. Lown, who was present to make a statement on behalf of the Poughkeepsie Gas Light Company, that the prayer should have been directed towards asking forgiveness for certain Supervisors who had asserted that the Gas Company had been receiving extortionate prices for the gas supplied under contract for the lighting of the Court House and the Jail. The following table shows that in 1894 the public lighting of the named buildings was carried on at a lower cost than any similar lighting was performed in the State:

Year.	Gas Used Cu. Ft.	Contract Price.	Net Price per M.
1891	230,000	$325	$1.41
1892	316,800	325	1.02
1893	319,200	500	1.56
1894	466,200	500	1.07

THE Burns motion, in the local Council of Toronto, to provide for an election in January next as to whether the city should engage in electric lighting on public and private account, was negatived on final vote.

THE Bath (Maine) Gas and Electric Company proposes to add to its electric equipment, for the purpose of engaging in the supply of electric currents for power purposes.

SUPERINTENDENT BEERS, of the Nanticoke (Pa.) Gas Company says that the plant recently completed at that point is satisfactory in every respect. The work of piping the houses is going on steadily.

THE people interested in the electric lighting supply of Denver, Colorado, would like to join forces with the Denver Gas Company, but the proprietors of the latter are not disposed to look with favor on the scheme. The Gas Company reports a gain in output for the year amounting to 9.8 per cent.

THE Pintsch system plant at Houston, Texas, will be completed by February first.

MR. J. B. CROCKETT and Mr. J. B. Grimwald recently escorted the chemistry class of the San Francisco Girls' High School (they had about fifty maidens to look after) through the San Francisco Company's manufacturing plant. It is needless to add that "the girls" had things their own way, saw everything there was to be seen, were told everything there was to tell, and were asked to call again.

THE Knox Gas and Electric Company, of Rockland, Me., has been awarded the contract for the public lighting of Rockland and Thomaston, by means of 1,200-candle power arcs, the agreement to run for five years, a moon table of 300 nights per annum to be followed, and the cost is to be $100 per lamp per year. When the Knox Company took over the gas and electric lighting supply of Rockland and Thomaston one very doubtful asset was the public lighting contract just terminated, and we think it was a doubtful asset from the fact that the rate paid by the city was only $69 per lamp per annum. To the credit of the Company, however, be it said, the contract was kept to the letter.

MR. ALBERT ROSENTHAL is overlooking, for the New York and East River Gas Company, the mainlaying that is being pushed with such celerity by that alert contractor, Mr. W. J. Murray.

IN our mention last week of the experiment in outdoor lighting, by means of the Welsbach incandescent burner, that is being conducted by the proprietors of the New York, Rutherford and Suburban Gas Company, we suggested that the price received per lamp ($36) per annum was rather excessive. We forgot, however, that each lantern carries two burners, which shows the price to be remarkably low.

THE Board of Aldermen of Long Island City, N. Y., have awarded a contract for the entire public lighting of that place by electricity to the Electric Illuminating and Power Company. The Company agreed to maintain 300 or more arcs, on the basis of a 1-year contract, at the rate of $164.29 per lamp per annum; but if a contract were awarded for five years the rate was to be $144.18. We do not know which proposition was accepted, but as said before, the Electric Company will carry on the service for at least a year from January 1st, 1895. The lighting is now carried on by means of a mixed system of gas lamps and arcs, the New York and East River Gas Company maintaining about 1,500 of the former, equipped with 4-foot burners, for which it was paid the decidedly steep price of $33 each per annum. The current for the electric lighting under the new contract will likely be furnished by the Steinway Railway Company, which operates a trolley road in Long Island City. The bid of the New York and East River Company for the lighting was $27 per lamp per annum.

THE gas and electric lighting interests of Santa Cruz, Cal., have been consolidated, the proprietors of the Gas Company dictating the terms.

THE bill passed by the lower house in the last session of Congress, known as House Bill No. 4279, which seeks to put the price of gas in the District of Columbia at $1 per 1,000, is now on the calendar of the appropriate Senate Committee, and some people in the know assert there is great likelihood of its enactment. The bill provides that after its passage the price of illuminating gas furnished to all consumers in the District shall not exceed $1 per 1,000 feet, it being provided that if consumers other than the Government shall not pay their gas bills within ten days upon presentation the Company collect at the rate of $1.25. The act of June 23, 1874, is amended to require the Gas Light Company to maintain its product at the equivalent of 22 candles and provides a penalty of $100 for each day on which there may be proved violation of this provision. The bill also makes provision for an extra clerk at $1,000 in the office of the Commissioners and an extra inspector of lamps at $900 to carry out the provisions of the act.

THE Worcester (Mass.) Gas Light Company reports an output of 20 million cubic feet during the month of November.

THE Consolidated Gas and Electric Light Company, of Rye and Port Chester, N. Y., has opened an office at Mamaroneck for the convenience of its customers in that section. Mr. Joseph D. Gunning is in charge of it.

THE AMERICAN GAS LIGHT JOURNAL

MONDAY, DECEMBER 17, 1894.

The Market for Gas Securities.

The market for city gas shares displayed unwonted activity since last time of writing, the feature being Consolidated, which advanced on active trading to something over 130, which is ex-dividend of 2 per cent., payable since Saturday last. On Friday the opening price was 129 to 129¼. The Company's business is increasing, and the impression is further gaining ground that Governor-elect Morton is not at all unfavorably inclined towards the gas industry. Equitable is strong, at 187 bid, and New York and East River common is 26½ bid. The meeting of this Company, set for the 11th inst., was adjourned. Brooklyn shares show no change, unless it be that easier values are apparent; meanwhile it can be taken for granted that gas matters over there are settled, although we may have to wait until June next before the features of the scheme are disclosed. Chicago is strong, and we think it a certainty that the next dividend will be 1½ per cent. Consumers, of Jersey City, is strong at 72 bid, and insiders say it will go to 90. Baltimore Consolidated is steady, at 66½ to 67. Our advertising columns show the declaration of a regular quarterly dividend of 4 per cent. by the Welsbach Light Company, as also an extra of 4 per cent., both payable now.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks,

35 Wall St., New York City.

December 17.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	129	129¼
Central	500,000	50	103	—
" Scrip	220,000	—	100	—
Equitable	4,000,000	100	187	—
" Bonds	1,000,000	—	107½	—
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	155	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Richmond Co., S. I.	348,650	50	50	—
" Bonds	100,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	38¾	41
Preferred	5,000,000	100	84	—
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	120	—
Citizens	1,200,000	20	60	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co.	2,000,000	100	—	—
Bonds	1,000,000	—	—	—
Fulton Municipal	3,000,000	100	175	—
" Bonds	300,000		103	—
Peoples	1,000,000	10	85	—
" Bonds (7's)	368,000	—	100	—
(6's)	94,000	—	98	100
Metropolitan	870,000	100	160	—
" Bonds (5's)	70,000	—	—	155
Nassau	1,000,000	25	200	—
" Ctfs.	700,000	1000	99	100
Williamsburgh	1,000,000	50	175	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	21	23
Income Bonds	2,000,000	1000	44	45
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	80	83
2d " " "	3,000,000	1000	59	—
Buffalo Mutual, N. Y.	750,000	100	120	—
" Bonds	200,000	1000	95	100
Chicago Gas Company.	25,000,000	100	73	73¼
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	93	93½
Consumers Gas Light Co., Jersey City	2,000,000	100	72	—
Bonds	600,000	1000	95	98
Cincinnati G. & C. Co.	7,000,000	100	202	204
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal.			90	100
Capital, Sacramento, Cal			—	50
Consolidated, Balt.	11,000,000	100	66⅝	66¾
" Bonds	6,400,000		107	107½

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WANTED,

A Situation as Superintendent of a Gas Works

By a sober, energetic young man. Can furnish best of references. Experienced in construction of gas and water works, and in the construction and operation of Gas, Water and Electric Light Plants. Competent in any or all of the different lines. also in office work. Would accept position as Assistant Supt. of large plant. No objection to location. Address
1019-2 "OHIO," care this Journal.

Position Desired

By a man 21 years of age, who has had considerable experience in the coal and water gas business. Can take meters, make connections, set meters, lay mains, put in services and stoves, and do any kind of work about a gas works. Best of references.
1018-2 "B. R. D.," care this Journal.

WANTED,

The Fort Dodge (Iowa) Gas, Electric Light and Power Company wish to purchase two 6 x 8 ft. (or 8 x 8 ft.)

CAST IRON PURIFYING BOXES,

with at least 12-inch Seal.
1019-1 J. FRANK ANDRES, Genl. Mgr.

WANTED TO PURCHASE,

Several Cheap Gas Plants,

in good towns of from 5,000 to 200,000 population. Address, with full particulars,
THE AMERICAN INVESTMENT AND FINANCIAL CO.,
1019-1 33 Wall Street, New York.

DIVIDEND NOTICE.

OFFICE OF WELSBACH LIGHT COMPANY,
DREXEL BUILDING, PHILA., PA., Dec. 12, 1894.

The Directors have this day declared the regular quarterly dividend of four (4) per cent., also an extra dividend of four (4) per cent. payable on Dec. 22, 1894, to stockholders of record at the close of business Dec. 15th. Checks will be mailed.
1019-1 EDWARD C. LEE, Treasurer.

David Leavitt Hough,

19 W. 31st St., N. Y. City.

Investment Property Appraiser, Consulting and Contracting Engineer.

Extensions to Existing Gas Plants and Initial Plants Designed.

Bids obtained, checked and tabulated, ready for Board or Committee meetings. *Work followed at the Shops to secure Proper Attention and Speed, and Inspected during Erection.*

POSITION WANTED

As Superintendent of Gas Works.

Twenty years' experience in every branch of the business—manufacturing, construction, mechanical and clerical. Have made the stove trade a specialty the past five years. Can also manage Electric Plant. Best of references as to ability from former and present employers, and well-known gas engineers. Best of reasons for a change. Address
1018-4 "M. L. S.," care this Journal.

MANUFACTURERS' AGENCY.

A salesman and general office man of 25 years' experience, energetic, capable and reliable, and accustomed to handling specialties, desires to represent a manufacturer from Jan. 1st. Either wrought iron pipe, or supplies for gas, steam, water, and oil; or a line of gas cookers and heaters, oil stoves, etc. Large acquaintance among jobbers, retailers and consumers. A1 references. Address, "L. S.," care this Journal.
1018-2

Purifying Boxes For Sale.

For sale, cheap,

TWO BOXES,

10 x 14 x 3, 16-in. connections and Center Seal for four boxes complete. All in first-class condition, and can be delivered immediately. For particulars address THE EAST RIVER GAS CO.,
1012-tf Long Island City, N. Y.

T. G. LANSDEN,

Consulting and Contracting Gas Engineer.

Estimates, Plans and Specifications for New Works (Coal or Water Gas), and for Extensions or Alterations.

Security Bldg. (Room 206), St. Louis, Mo.

Patent Lava Gas Tips.

UNIFORMITY GUARANTEED.
ALL SIZES AND SHAPES.

D. M. STEWARD MFG. CO.,
CHATTANOOGA, TENN.

MOSES G. WILDER,

Mechanical Engineer,

816-822 Cherry St., Phila., Pa.

MANUFACTURER OF

Gas Governors, Governor Gas Burners, Gas Cocks and Fittings,

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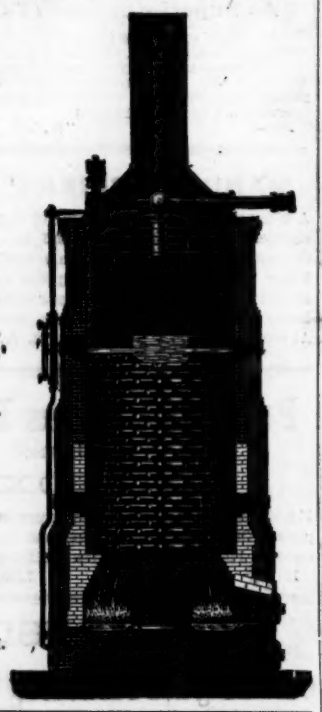

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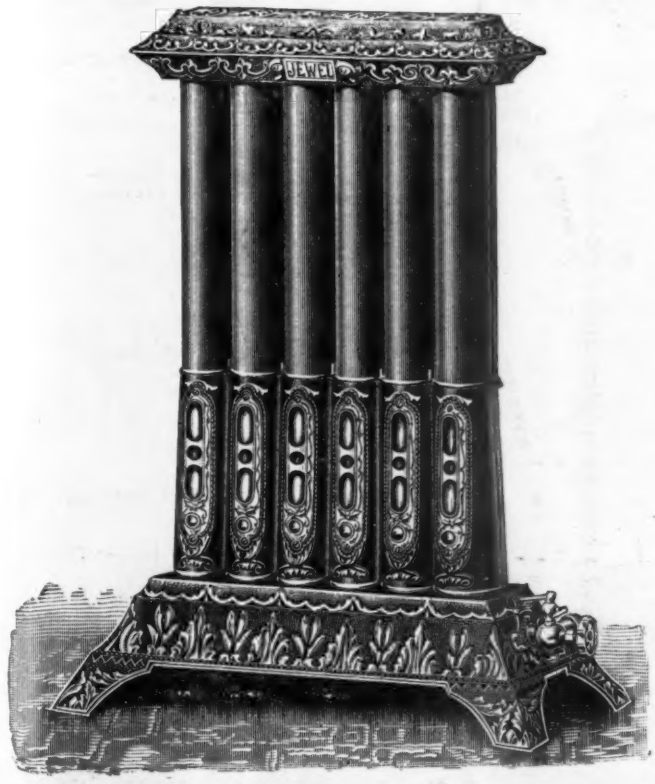

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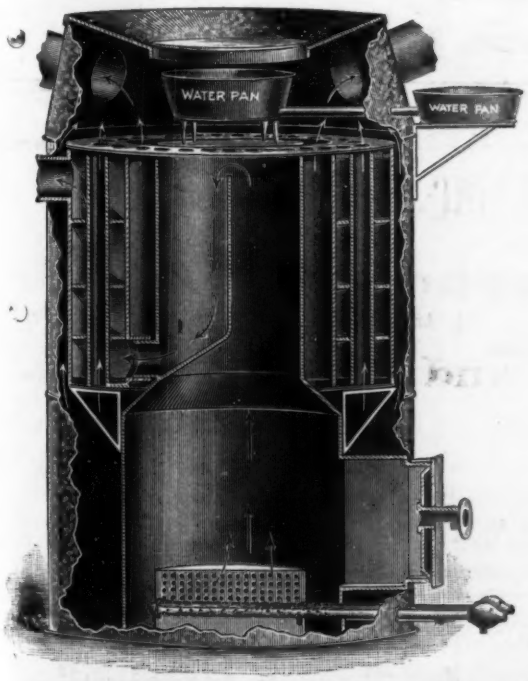

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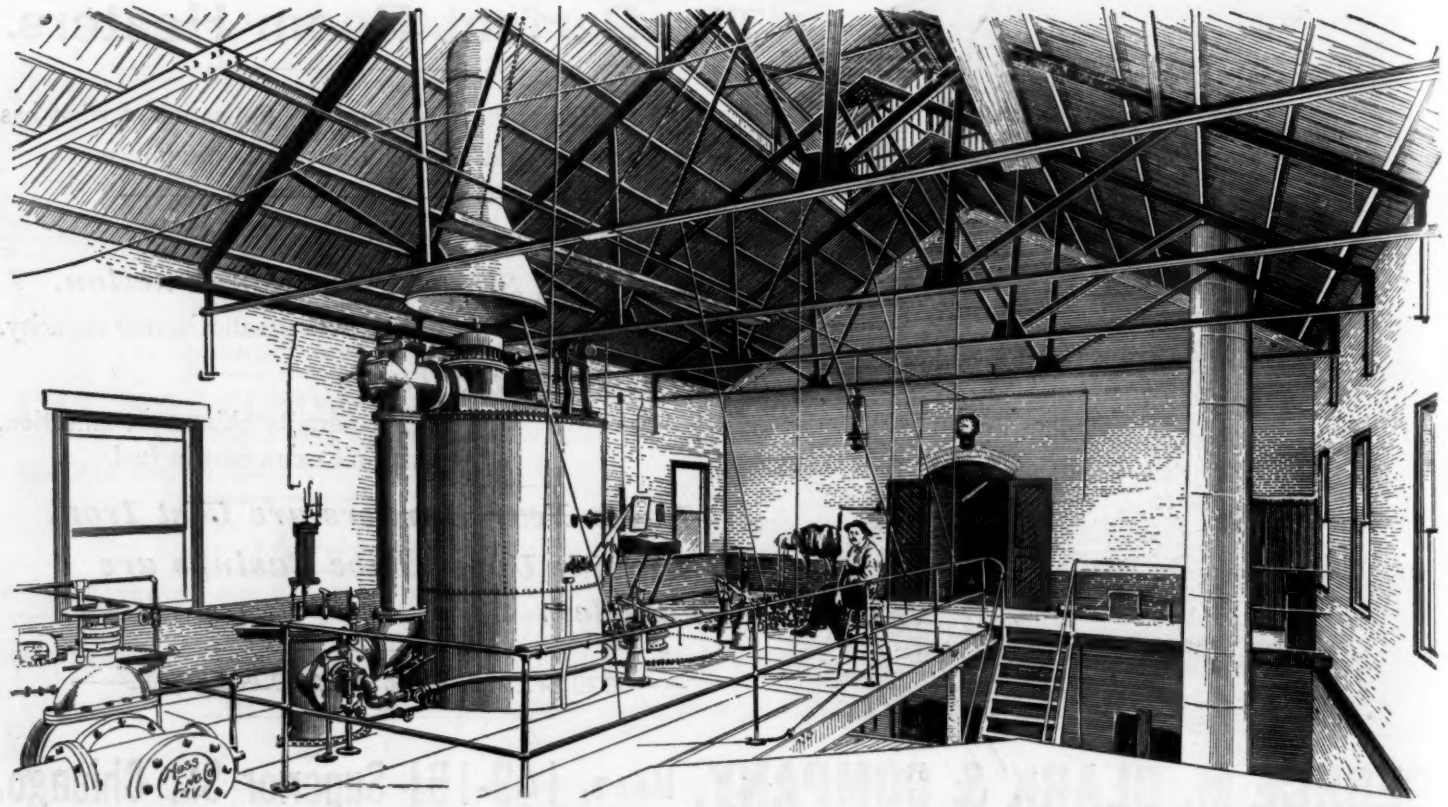

The above illustration is taken from a photograph, and shows the Machine Room of the New Bedford Gas Co., at New Bedford, Mass. The Roof on this building was furnished by us. The building is 32 feet in width by 50 feet in length, the Roof being made entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The room is ventilated by a wrought iron ventilator extending the full length of the building, with corrugated shutters on each side opening and closing by cords from the floor.

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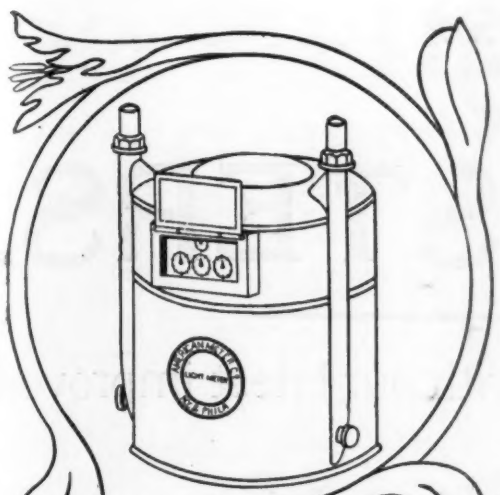

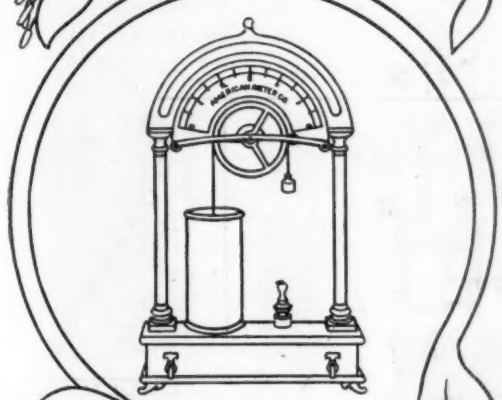

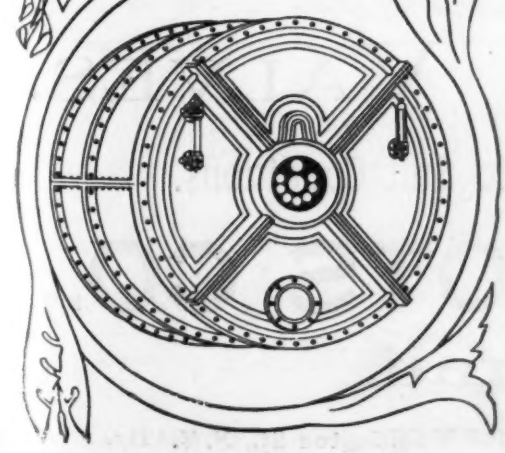

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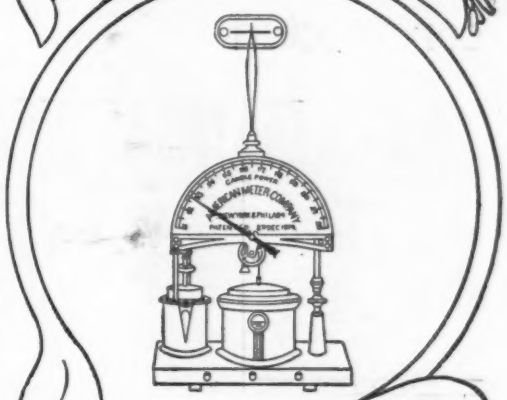
PUBLIC LIGHTING TABLE.

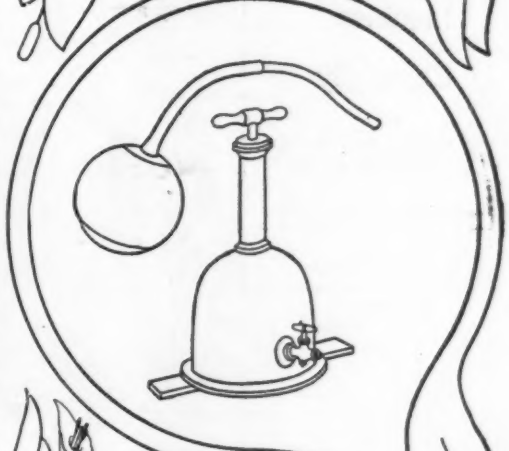
JANUARY, 1895.

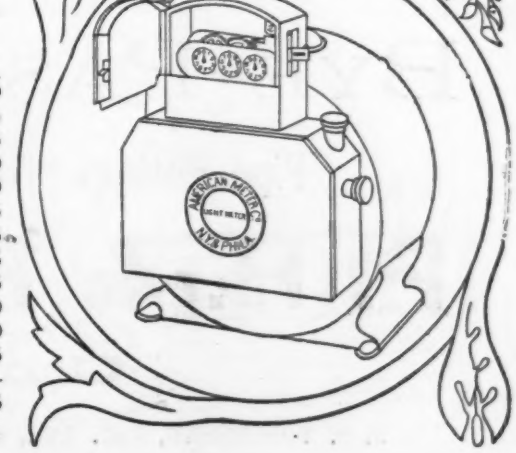
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Tue.	1	9.10 PM	6.20 AM	4.30	6.30
Wed.	2	10.10	6.20	4.30	6.30
Thu.	3	11.10 FQ	6.20	4.30	6.30
Fri.	4	12.10 AM	6.20	4.30	6.30
Sat.	5	1.20	6.20	4.30	6.30
Sun.	6	2.30	6.20	4.30	6.30
Mon.	7	3.50	6.20	4.30	6.30
Tue.	8	5.00	6.20	4.40	6.30
Wed.	9	No L.	No L.	4.40	6.30
Thu.	10	No L. FM	No L.	4.40	6.30
Fri.	11	No L.	No L.	4.40	6.30
Sat.	12	5.30 PM	7.40 PM	4.40	6.30
Sun.	13	5.30	9.00	4.40	6.30
Mon.	14	5.30	10.20	4.40	6.30
Tue.	15	5.30	11.30	4.50	6.25
Wed.	16	5.30	12.40	4.50	6.25
Thu.	17	5.30 LQ	1.50 AM	4.50	6.25
Fri.	18	5.30	3.00	4.50	6.25
Sat.	19	5.30	4.10	4.50	6.25
Sun.	20	5.40	5.20	4.50	6.25
Mon.	21	5.40	6.10	4.50	6.25
Tue.	22	5.40	6.10	5.00	6.25
Wed.	23	5.40	6.10	5.00	6.25
Thu.	24	5.40	6.10	5.00	6.25
Fri.	25	5.40 NM	6.10	5.00	6.25
Sat.	26	5.40	6.10	5.00	6.25
Sun.	27	5.40	6.10	5.00	6.25
Mon.	28	5.40	6.10	5.00	6.25
Tue.	29	5.40	6.10	5.05	6.15
Wed.	30	9.00	6.10	5.05	6.15
Thu.	31	10.00	6.10	5.05	6.15

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146.30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45







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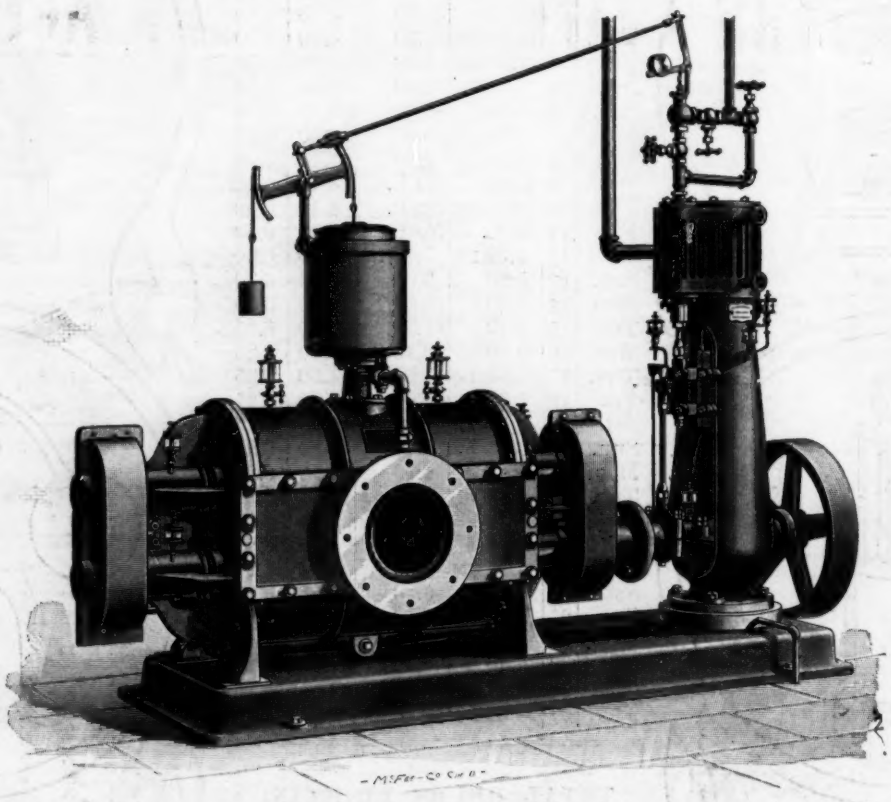

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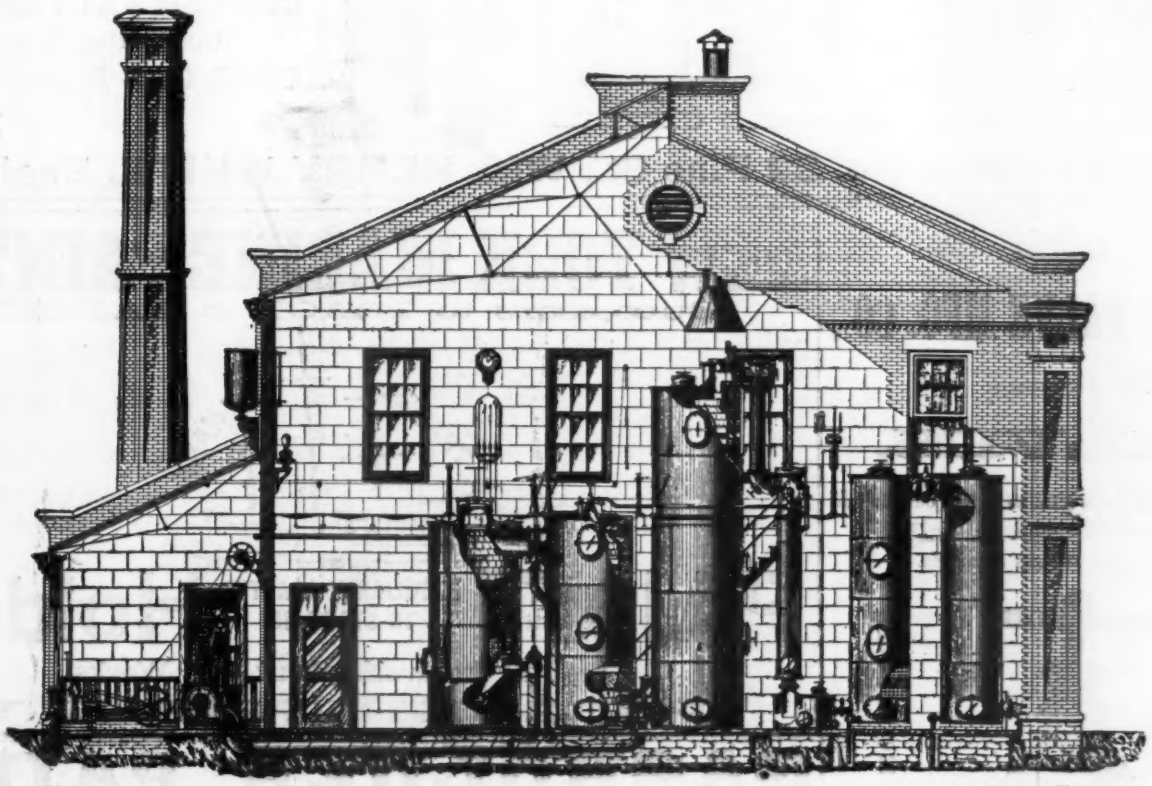

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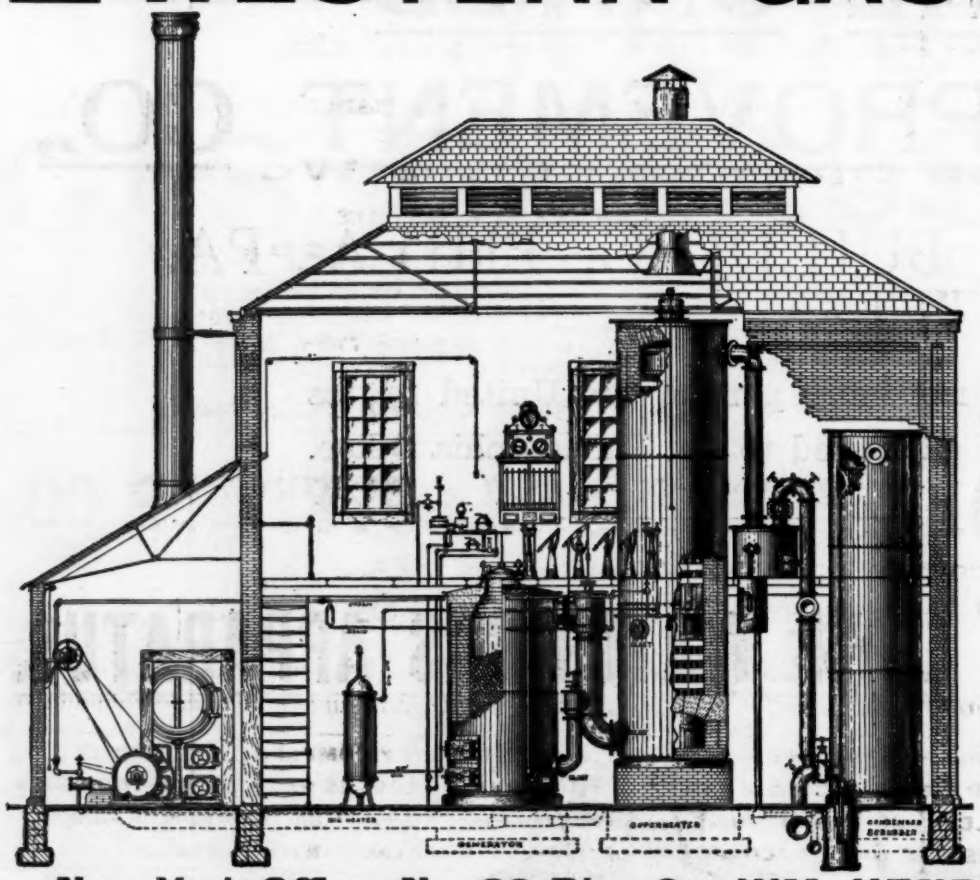

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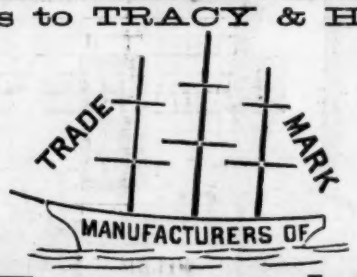

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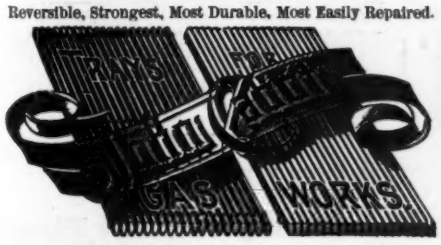

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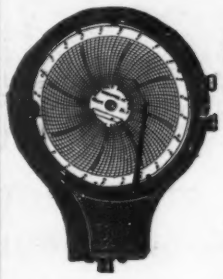

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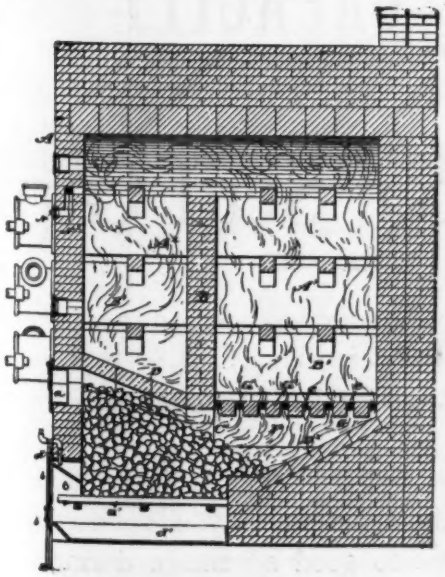

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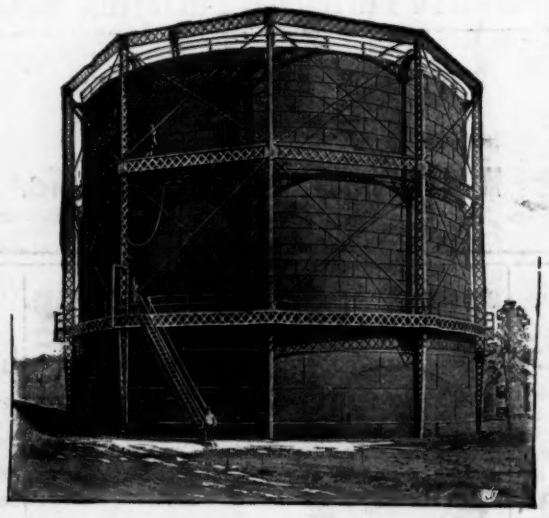

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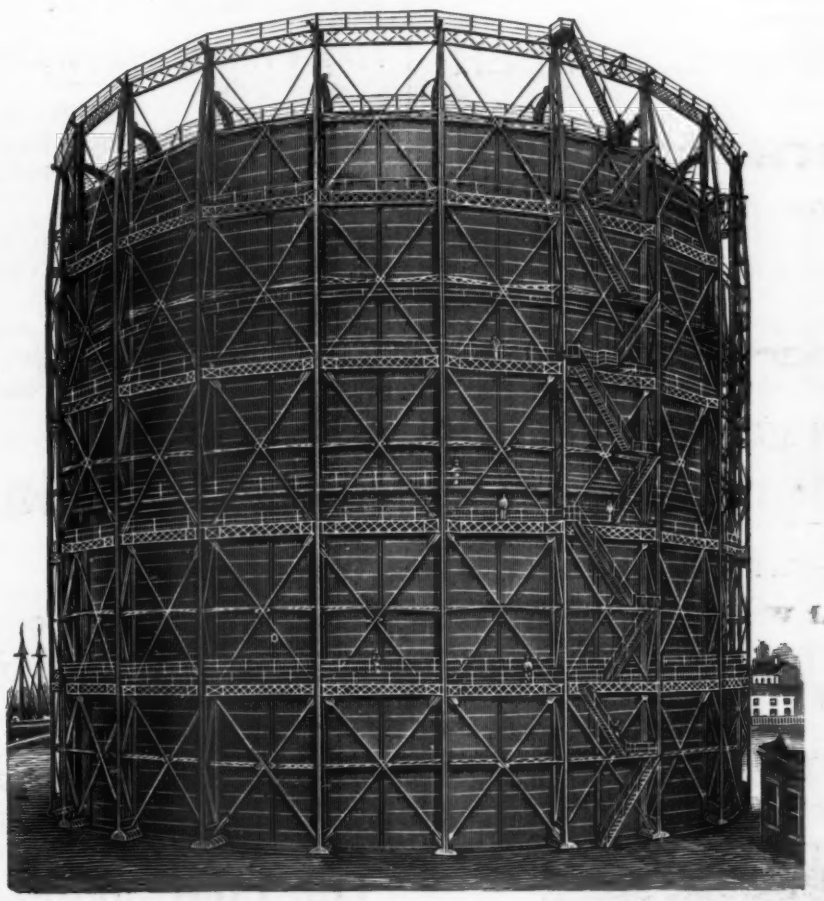

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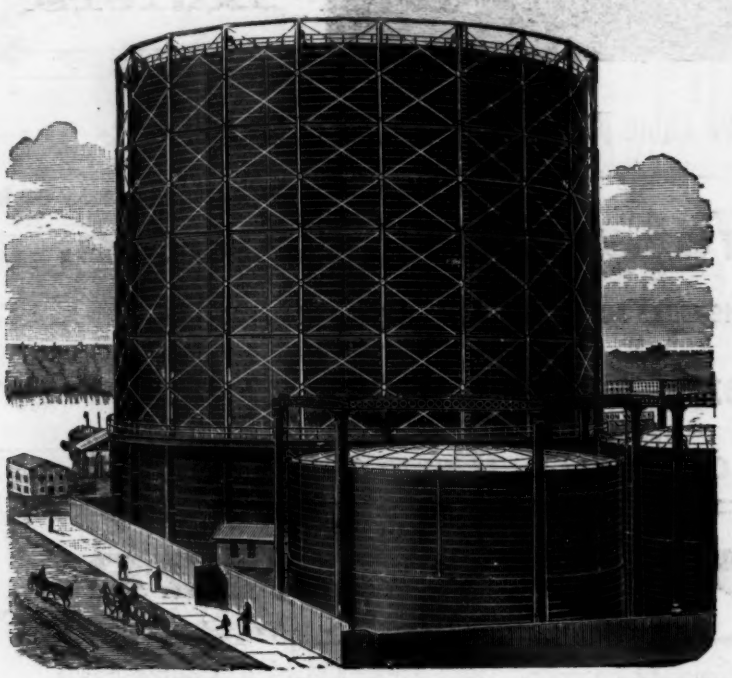

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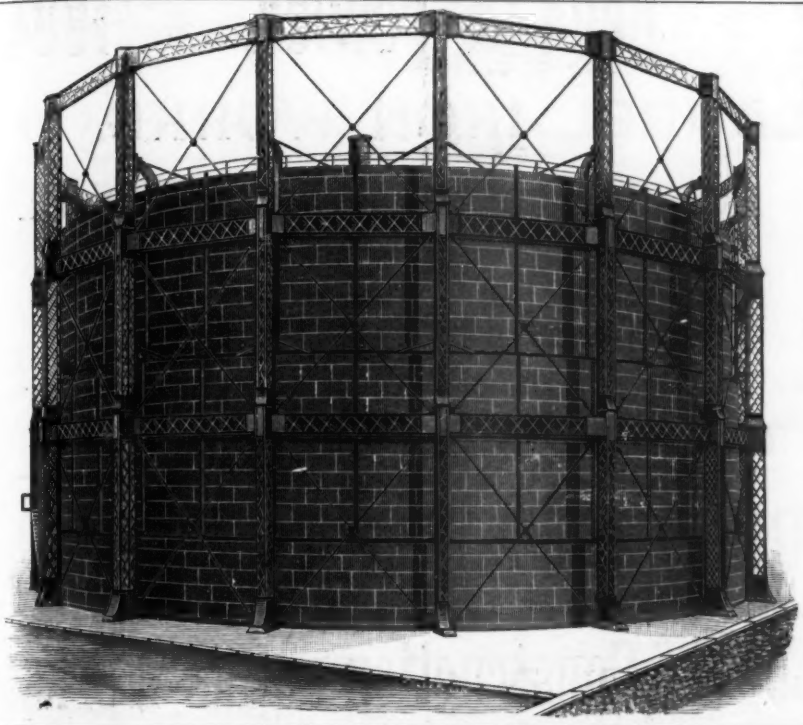

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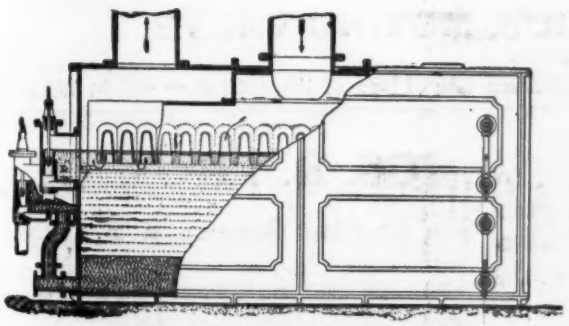

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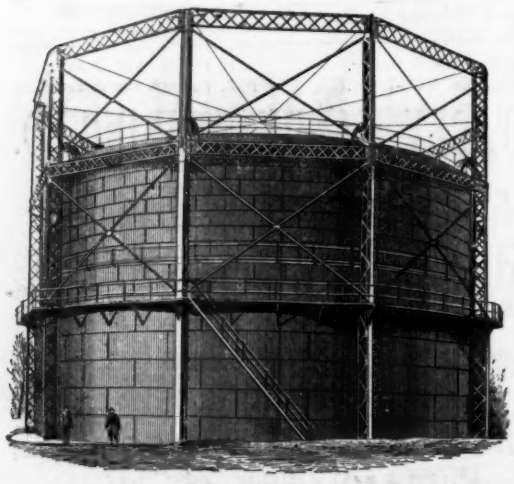

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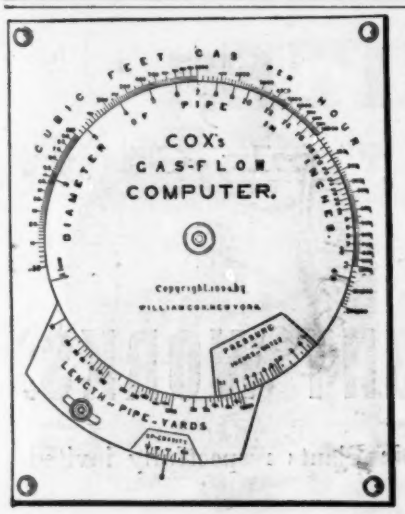

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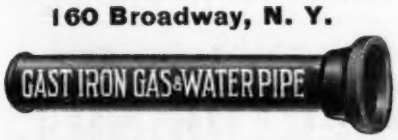

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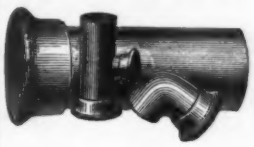

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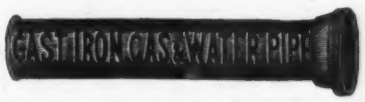

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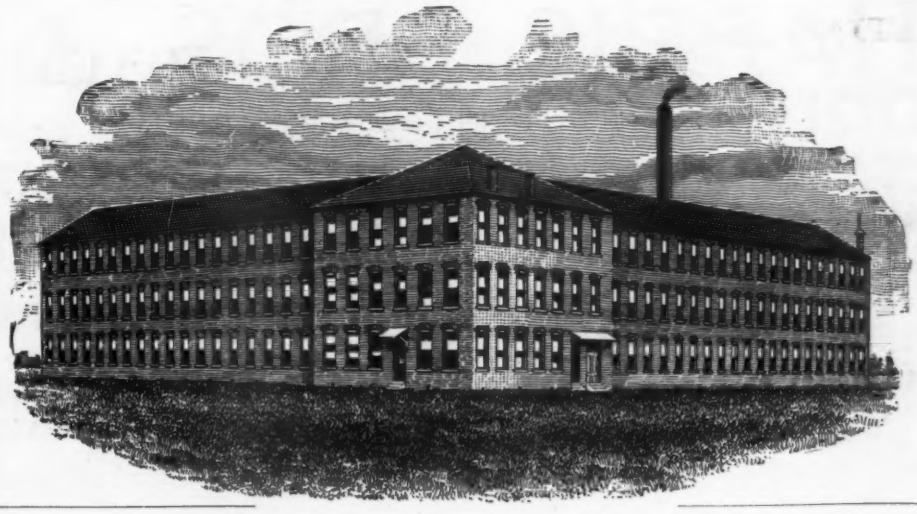

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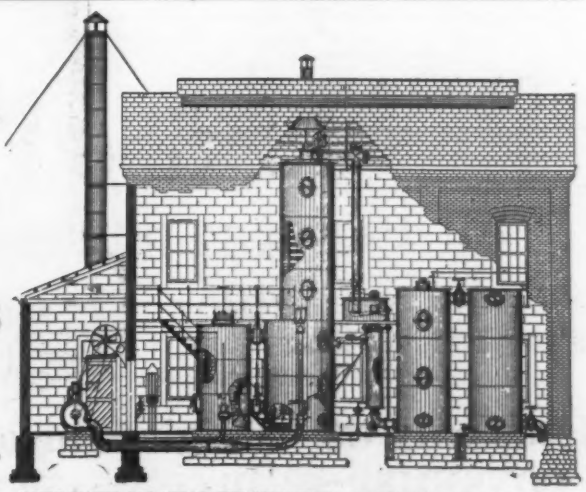

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